Kew.

QK1
.B956
1891

ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

1891.

MISSOURI
BOTANICAL
GARDEN.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Three Shillings.

SHOUT
SHARE
IT

CONTENTS.

Date.	Article.	Subject.	Page.
1891. January	CLXXXII.	West African bass fibre (*Raphia vinifera*, P. de Beauv.).	1
„	CLXXXIII.	Chinese ginger (*Alpinia Galanga*, Willd.)	5
„	CLXXXIV.	Production of seed and seminal variation in the sugar-cane.	10
February	CLXXXV.	Ipoh poison of the Malay Peninsula (*Antiaris toxicaria*, Lesch.).	25
„	CLXXXVI.	Kath, or pale cutch (*Acacia Catechu*, and *A. Suma*).	31
„	CLXXXVII.	Production of cane-sugar in the sugar-cane.	35
„	CLXXXVIII.	Timber of Yoruba-land - - -	41
„	CLXXXIX.	Phylloxera - - - -	44
„	CXC.	Botanical station at Lagos - -	46
„	CXCI.	Mealy-bug at Alexandria - - -	48
March	CXCII.	Cotton in West Africa - - -	49
„	CXCIII.	List of orchids flowered at Kew in 1890 -	52
„	CXCIV.	Dammar from New Caledonia - -	76
April	CXCV.	Persian tobacco or tombak (*Nicotiana Tabacum*, L.).	77
„	CXCVI.	Botanical enterprise in the Niger Protectorate.	84
„	CXCVII.	Aden barilla (*Suæda fruticosa*, L.) -	96
„	CXCVIII.	Assam rubber for West Africa (*Ficus elastica*, Bl.).	97
May and June	CXCIX.	Botanical enterprise in the West Indies, 1890–91. (Mr. Morris' Mission.)	103
July	CC.	Gold Coast botanical station - -	169
„	CCI.	Bahamas industries - - -	175
„	CCII.	Argel leaves (*Solenostemma Argel*, Hayne).	177
„	CCIII.	Paraguay jaborandi (*Pilocarpus pennatifolius*, Lem.).	179
„	CCIV.	Journey in Nyassaland - - -	183
„	CCV.	African oil palm (*Elæis guineensis*, Jacq.)	190
August	CCVI.	Orchid nomenclature - - -	193
„	CCVII.	New garden orchids: decade i. - -	197
„	CCVIII.	Artificial coffee-beans - - -	201
„	CCIX.	Kanaff or Deccan hemp (*Hibiscus cannabinus*, L.).	204
„	CCX.	Indigenous plants of Yoruba land -	206
„	CCXI.	Planting in Perak - - -	220
September	CCXII.	Orange-scale in Cyprus (*Aspidiotus aurantii*), with plate.	221
„	CCXIII.	Re-discovery of gutta percha tree at Singapore (*Dichopsis Gutta*, Benth.).	230
„	CCXIV.	New process for recovering loss of gutta percha.	231

Date.	Article.	Subject.	Page
1891. September	CCXV.	Tagasaste (*Cytisus proliferus*, Linn.) -	239
”	CCXVI.	Kangra buckwheat (*Fagopyrum tataricum*, var.).	244
”	CCXVII.	Miscellaneous notes - -	245
October and November	CCXVIII.	Chinese fibres - - - -	247
”	CCXIX.	Ipoh poison of the Malay Peninsula (continued from page 30).	259
”	CCXX.	Botany of the Gambia Delimitation Commission.	268
”	CCXXI.	Miscellaneous notes - - -	275
December	CCXXII.	Historical Account of Kew to 1841 -	279
Appendix I. -	—	List of seeds of hardy herbaceous plants, and of trees and shrubs.	1
” II. -	—	New garden plants - - -	33
” III. -	—	Botanical departments at home and abroad	55
” IV. -	—	Index to *Kew Bulletin*, 1887–91 -	63

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 49.] JANUARY. [1891.

CLXXXII.—WEST AFRICAN BASS FIBRE.

Raphia vinifera, P. de Beauv.

This palm is described in the *Flore d'Oware et de Benin,* vol. I. p. 76 (tab. 44, fig. I. et tabb. 45 and 46), from which the following notes have been extracted. It is very abundant on the borders of rivers intersecting the countries near the sea in the kingdoms of Oware and Benin. The tree is of medium height, having leaves of from 6 to 7 feet or more in length with spiny leaflets. The fruiting spadix is very large, about 4 feet long, and forms a heavy load for one man to carry. What this tree lacks in height is compensated for by the beauty of its form, the brightness of its colour, and its imbricated shining fruits. The stems are used to form the framework of native dwellings, and the leaves, bound with lianes, are used for thatching. Huts so built are substantial, and afford a good protection from the rain and heat of the sun, but at the same time serve as a haunt for vipers, rats, and other vermin. From the trunk an intoxicating beverage of a whitish colour is obtained, and is called by the natives "Bourdon"; it is not quite so sweet as ordinary palm wine, but is more vinous, and appears to contain a larger quantity of spirit. The fruits of this palm, which are collected all the year round, are likewise

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
21, DRURY STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Twopence.

said to afford a beverage of a second quality which will keep for a considerable time.

The *Board of Trade Journal* [November 1890 p. 596] quotes from the *Lagos Weekly Times* an account of the fibre, and states that it "promises to become an important and valuable addition to the exports from Lagos."

It will probably be found a useful substitute for Piassava, an account of which was given in the October Bulletin for 1889.

The following correspondence has taken place between this establishment and the Colonial Office on the subject.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, October 3, 1890.

I AM directed by Lord Knutsford to transmit to you a copy of a despatch from the Governor of Lagos, reporting that he had forwarded to you, for analysis and report, a box containing 20 lbs. of bass fibre obtained from the *Raphia vinifera.*

Lord Knutsford will be glad to be informed of the result of your examination of the parcel in question.

I am, &c.
(Signed) EDWARD WINGFIELD.

The Director, Royal Gardens, Kew.

Sir A. MOLONEY to COLONIAL OFFICE.

Government House, Lagos,
MY LORD, August 20, 1890.

I HAVE the honour to report that there will go forward by the next mail steamer addressed to the Royal Gardens, Kew, a box containing 20 lbs. of a bass fibre obtained from the *Raphia vinifera* or wine palm of West Tropical Africa.

2. The sample I had hurriedly prepared during my last visit to the eastern district.

3. On its "find," area of supply, local preparation and uses, as also on its prospects as an export for which I anticipate a bright and profitable future, I have drawn up a minute with a view to its advertisement.

4. May I ask your Lordship to let the Director of the Royal Gardens, Kew, who takes such deep interest and gives such encouragement to the development of the economic botany of our colonies, have a copy of this despatch, and to allow of the circulation of the minute among the various Chambers of Commerce.

5. I attach a copy of the notice that has locally appeared inviting the attention of the public to this fibre.

I have, &c.
(Signed) ALFRED MOLONEY,
Governor.

The Right Hon.
Lord Knutsford, G.C.M.G., &c.

EXTRACT of MINUTE by the Governor of Lagos on the Bass fibre of the Bamboo palm (*Raphia vinifera*).

In a letter received by me, shortly after my arrival in Lagos in February last, from a well-known Manchester firm, a sample of a fibre known as "African Bass" was forwarded, with the following remarks:—

"If this can be found and shipped in quantity I could sell large quantities. It should be kept straight, tied up first in small bundles, thickness of a man's wrist, and these made up into bales of about half a hundredweight each. It must be kept straight, whatever the length, as the bends spoil the fibre and makes its difficult to work."

* * * *

"Please note the brown fully mature fibre is preferable to the light red colour; present value 30*l.* to 32*l.* per ton."

In the "African Bass" of which the sample was sent to me I was surprised to recognise one of the commonest of the native fibres of this colony, used, I may say, by every fisherman in the manufacture of his lines, and prepared from one of the most plentiful of the palm trees of the colony, the *Raphia vinifera*, or "Bamboo" palm.

The "African Bass" is in appearance a stiff and wiry fibre, varying in colour from dark brown to light red, dependent for its shades on duration of soaking. It is most readily obtained in lengths of from 3 feet to 4 feet, beyond which length it is inconvenient to pack and difficult to procure without injury to the tree. In diameter it varies from $\frac{1}{16}$ to $\frac{1}{30}$ of an inch, the latter of which may be accepted as the limit of fineness to be admitted in a commercial sample for the European market. It is used, I believe, mainly in the manufactnre of hard brushes for various domestic and manufacturing purposes. The demand appears to be very large, and the price, as shown above, is exceedingly satisfactory.

The source of its supply in this colony alone may be said to be practically inexhaustible, as will readily be acknowledged when its origin is explained.

The "Bamboo" palm, or *Raphia vinifera*, is perhaps the commonest tree in the swamps and low lands which line the waterways of the colony. Dense thickets of these palms, traversed only by the palm wine gatherer or the bamboo cutter, push their way into the lagoons, and extend over the flood grounds, and even to a distance of from 15 to 20 miles up the river valleys into the interior. The area occupied by these *Raphia* forests it would be impossible to calculate, but it may be accepted without doubt that they extend throughout the length of the colony, and to a distance of at least 15 miles from the sea coast, and that over this area of about 5,000 square miles they form a considerable proportion of the vegetation, next only in numbers to the Oil palm (*Elæis guineensis*) and the Mangrove (*Rhizophora mucronata*). The fact that one can steam for miles, as I have frequently done, wondering to what commercial advantage they could be put, through uninterrupted *Raphia* groves on either hand in the Eastern waters, impresses one with the extent of the acreage which must be overrun by this graceful palm.

Everybody in the colony is aware of the manifold uses of the *Raphia* palm; how from its leaves hats, cloth, and cordage are made, from its leaf-stems rafters, fences, and walls, and from its crown of young unopened leaves palm wine of excellent quality. Of one part only the use seems not generally known, and it would appear that this particular portion of the tree, though hitherto treated as useless, is in reality of more value than all the rest.

When the "Bamboo" cutter clears away the leaves from the lower stem of the palms the trees present a very ragged and uneven appearance, owing to the practice of leaving a portion of the leaf-stalk adhering to the parent stem. These base-stalks partially encase the bole of the tree and project upward and outwards, forming the scaly covering which gives so strange an appearance to a grove of *Raphia* palms. From these stumps of the leaf-stalks the native fishing lines are made. The fibre is extracted by a process of soaking and scraping, which is exceedingly simple and is fully understood by every bamboo cutter and line maker. It is this fibre which is known in the European market as "African Bass," and there is no apparent reason why with a population who are in the habit of preparing it, and a source of supply which may be regarded as practically unlimited, we should not be able to compete on even terms with the sources of supply which at present monopolise the market.

* * * *

In the Yoruba language the *Raphia vinifera* is known as *Igi-oguro*, *Eriko* and *Akpako*, the Bass fibre as *Iyo*, and the fishing line *Iyo-oguro* or *Iyo-agbe*. Along the inland waters or lagoons from Popo to Mahin the natives use this fibre for fishing lines, and as twine and rope.

MESSRS. IDE AND CHRISTIE to ROYAL GARDENS, KEW.

72, Mark Lane, London, E.C.,
October 10, 1890.

DEAR SIR,

WE duly received your letter of 8th instant, and to-day brings us the sample of fibrous material found at the base of the leaves of the "Bamboo" palm of West Africa (*Raphia vinifera*).

We have seen this material before, and the small importations that were made (some years ago) were not at all well received by consumers, who found that the expense of cleaning and the ultimate result were most unsatisfactory when compared with the price and results of South American Piassava.

During the past year or two, however, the market values of the latter have undergone a great change, Bahia Piassava having largely risen in price. We think, therefore, that it might be well worthy of producers' attention were they to select only these fibres of which we return you specimens herewith, and clean them effectively from all the adherent small fibre. Only the strong healthy fibres should be selected and prepared, and the various lengths should be bundled separately.

The material being somewhat of a novelty, it might be well for shippers to confine their first shipment to, say, 10 to 20 tons, so as to try the market adequately. If properly selected and cleaned we estimate that it would sell at 25*l.* per ton to-day in London, a figure that, in our opinion, should leave a handsome profit to the producer.

Yours, &c.
(Signed) IDE AND CHRISTIE.

D. Morris, Esq., M.A., F.L.S.

MESSRS. IDE AND CHRISTIE to ROYAL GARDENS, KEW.

72, Mark Lane, E.C.,
DEAR SIR, October 24, 1890.

WE have your favour of the 23rd instant, and duly note the contents of enclosed extract from Minute of Governor of Lagos on the fibre of *Raphia vinifera.*

Since we last wrote to you on this subject, a few bales of "African Bast" recently imported have been sold and reached the extreme price of 42*l.* The fibre had been carefully selected and remarkably well cleaned, hence the excellent market it met with. We scarcely expect this price would be maintained for substantial quantities, but for fibre of equal merit the immediate outlook would seem to indicate that 35*l.* to 40*l.* might be the range of value.

Yours, &c.
(Signed) IDE AND CHRISTIE.

D. Morris, Esq., M.A., F.L.S.

CLXXXIII.—CHINESE GINGER.

Alpinia Galanga, Willd.

Every one is familiar with the preserved ginger which comes to our dessert tables from China, and is imported in earthenware jars of more or less artistic merit. As long ago as 1878, Dr. Perceval Wright, Professor of Botany in the University of Dublin, wrote to Kew, pointing out that the "large flat finger-like masses sent to this country from China as preserved ginger," differed from anything that the ordinary ginger plant (*Zingiber officinale*) could possibly produce. The fact itself was obvious as soon as it was pointed out.

The question then naturally arose what was the plant used by the Chinese. Ginger itself, as is the case with so many cultivated plants, is unknown in a wild state. But there can be little doubt that it is a native of Asia. It was known as a spice to the Greeks and Romans, who received it by way of the Red Sea and supposed it to be a production of southern Arabia. It was very early introduced into the West Indies, from which it was shipped for commercial purposes to Europe as early as the 16th century. The dried ginger met with in British commerce is almost entirely derived from the West Indies, Sierra Leone, Egypt, and India. It is noteworthy that we receive none from China.

At the instance of Professor Perceval Wright, Mr. G. H. M. Playfair (of H. M. Chinese Consular service) sent a Wardian case of the Chinese plant to Kew in 1878. The plants were propagated without difficulty and largely distributed to tropical colonies. Unfortunately this brought us no nearer the solution of the difficulty. That the plant was different to ordinary ginger was obvious. But plants of the ginger family, as is the case with many plants which are easily propagated by their rhizomes, are shy of flowering in cultivation, while their foliage is all so much alike that it affords no adequate means of discrimination. The plant obstinately refused to flower at Kew, as it also appears to have done in Ceylon, and there was nothing to do but wait till some lucky chance as to conditions of growth in some colonial garden enabled Kew to be furnished with the necessary material for identification.

In the meantime, a root of a ginger from Siam shown in the Health Exhibition at South Kensington in 1884 proved to be alive when received at the Kew Museum. As it obviously differed from the ginger of the shops it was handed over to the assistant curator, Mr. Watson, for growing. He succeeded in raising plants from it, and ultimately in flowering it in 1886, when he communicated the following account to the *Gardeners' Chronicle* (July 31, 1886, p. 150).

" *Siam Ginger*.—Amongst the collection of fruits, &c. shown by the Siam Commission at the International Health Exhibition, held at South Kensington in 1884, were some roots labelled 'Ginger.' These were obtained for the Kew Museum, but one of them being alive was planted to grow, and it is now bearing stems 5 feet high, and is in flower. On comparing it with the drawings and specimens in the Herbarium, Mr. Baker has identified it with a specimen labelled '*Alpinia* sp., Bangkok,' which was collected by Sir R. Schomburgh in 1864, and which is very near to *A. Allughas*, also a native of Siam, where, according to Schomburgh, it is cultivated for its Cardamomum-like fruits, and is known as as *Luk-Reu* or Bastard Cardamom. Under the name of Galangal, *A. officinarum*, a Chinese species is cultivated for the sake of its aromatic rhizomes, and this unnamed species now in flower at Kew is apparently largely cultivated by the Siamese as a substitute for Ginger. The rhizome is very thick, slightly flattened, and not so freely branched as in common Ginger; it has the pungent aromatic properties of Ginger, so far at least as could be told by tasting it. There is some reason for believing that the Chinese Ginger of commerce is not obtained from *Zingiber officinale*, the source of Jamaica Ginger, but from a species of *Alpinia*, and possibly this unnamed one at Kew. Plants of true Chinese Ginger are now growing at Kew, and these may soon flower; at present they have the same habit, broad leaf and rhizome, of the Siam plant. In *Zingiber officinale* the inflorescence is borne on a separate short stem without leaves, the barren stems being about 3 feet high, and clothed with narrow spear-shaped foliage; in *Alpinia* the flowers are borne in panicles on the ends of the stout leaf-stems, the well known *A. nutans* and the newer *A. mutica*, both beautiful garden plants, being familiar examples."

In 1887 Sir Joseph Hooker figured the plant in the *Botanical Magazine* (tab. 6944) as a new species, *Alpinia zingiberina*. The rhizome he describes as "very aromatic;" they "smell and taste a good deal "like the officinal plant; they are, however, very much larger, at "least three times as thick, are much more shortly and irregularly "branched, and the branches are thickened in the middle."

Mr. Baker in working up the *Scitamineæ* for the *Flora of British India* has arrived at the conclusion that *Alpinia zingiberina* is not essentially distinct from *Alpinia Galanga*, Willd., the Greater Galangal, a plant originally native of Java and Sumatra now much cultivated in India for its rhizome.

In December 1888 we received the first authentic flowering specimen of the "Chinese Ginger" from the Botanical Department, Jamaica. It was grown at the Hope Gardens, by the Superintendent, Mr. Harris. This proved, as suspected by Mr. Watson, to be an *Alpinia*, and also identical with the Siam plant. It is in fact nothing more than the well known *Alpinia Galanga*.

Specimens received in the present year from the indefatigable correspondent of Kew in Dominica, Dr. Alford Nicholls, F.L.S., confirm this result, and Mr. Ford, the Superintendent of the Botanical and Afforestation Department, Hong Kong, having flowered the plant in the Hong Kong Botanic Garden, arrives at the same conclusion.

Professor PERCEVAL WRIGHT to ROYAL GARDENS, KEW.

Trinity College, Dublin,
June 4, 1878.

MY DEAR DYER,

FOR some time I have been anxious to know the species of plant which produces the large flat finger-like masses sent to this country from China as preserved ginger. I never found the Jamaica ginger produce such massive stems. I according wrote early in this year to an old pupil, Mr. Playfair, who is in the Consulate at Swatow, to collect me all the information he could, and this morning I got a letter from Swatow, April 25th, 1878, saying that by the same mail that brings it, a friend of his, Mr. T. W. Richardson, sails, "bringing in a Wardian " case half a dozen of the young ginger shoots, which he will on " arrival in London take or send to Kew. I have given him a letter " to Sir J. D. Hooker asking the latter to forward the plants to you, " and suggesting that if all survive, he should, if he cared for them, " keep one or two at Kew."

Should they turn up and prove all sickly, will you kindly ask that they be all cared for at Kew before coming on another journey.

Yours, &c.
(Signed) E. P. WRIGHT.

G. M. H. PLAYFAIR, ESQ., to ROYAL GARDENS, KEW.

H.B.M. Consulate, Swatow,
April 22, 1878.

DEAR SIR,

I HAVE been requested by Dr. E. P. Wright, Professor of Botany, Trinity College, Dublin, to send him some specimens of the plant from the root of which the preserve, known as "Chinese Ginger," is made. By good fortune a gentleman at this port, Mr. T. W. Richardson, is on the eve of his departare for England, taking with him various plants in a Wardian case, and he has most kindly offered to take six young ginger plants among them to be transmitted to you, as Dr. Wright suggested, for transmission to Dublin.

Should the whole or the greater portion of these plants survive the journey, I hope you will not scruple to detain some of them for the Kew collection if they are required, and I shall feel much obliged if you will be so kind as to forward the remainder to Dr. Wright, at Dublin.

Later I hope to find a convenient opportunity of sending tubers, leaves, flowers, &c. of the mature plant preserved in salt and water, or otherwise, for the Dublin Botanical Museum, and I shall again venture on the liberty of addressing the packages to your care.

I forward this letter favoured by Mr. Richardson.

Yours, &c.
(Signed) G. M. H. PLAYFAIR.

Sir J. D. Hooker, K.C.S.I., C.B.

G. M. H. PLAYFAIR, ESQ., to ROYAL GARDENS, KEW.

H.B.M. Consulate, Amoy,
April 10, 1885.

MY DEAR MR. DYER,

I REMEMBER perfectly sending home those roots of *Zingiber* in a Wardian case, in 1878, to Dr. Edward Perceval Wright. If my memory serves me, I did not send any plants or parts of plants in salt and water. What Dr. Wright wanted was such parts of the plant as could be utilized for the purposes of botanical identification, such as the flowers, or, failing these, at any rate the fruit. But it has been established as incontrovertible by Dr. Hance that the ginger plant in China never flowers. He has been in the country since 1861, and is not likely to be mistaken; the natives, moreover, assert the same. The plant is propagated entirely by tubers, I believe. It is hopeless, therefore, to hope to identify it fully. Dr. Hance told me in 1878, when I made inquiries on the subject at the instance of Dr. E. P. Wright, that, in his opinion, the Chinese plant is *Zingiber officinale*, and identical with West Indian ginger. I may state that he has seen a flowering *Zingiber*, but it was a wild plant, and not the variety used for the manufacture of sweetmeats. An application to him would, doubtless, elicit more detailed information on the point.

Canton is the head-quarters of preserving ginger; the plant grows here too, and is used as a condiment, but not as a sweetmeat. As I said above, it is, to my knowledge, impossible to obtain either a flowering or fruiting specimen. If you would let me know whether the leaves and tubers alone would be of any use to you, I should be happy to procure any quantity; but, apprehending that such would be no practical utility, I shall await further orders.

Yours, &c.,
(Signed) G. M. H. PLAYFAIR.

W. T. Thiselton Dyer, Esq., C.M.G.

EXTRACT from Dr. Trimen's Report on the Royal Botanic Gardens, Péradeniya, for 1885, p. 12.

Chinese Ginger.—Of this plant, the source of the *preserved* ginger of commerce, nothing is certainly known. In China, where it is grown, it is said never to flower. I have received from Kew a box of roots, which are growing well at Péradeniya. The plant is clearly quite distinct from ordinary ginger, and I await its flowering with interest.

EXTRACT from Mr. Ford's Report on the Hong Kong Botanical and Afforestation Department for 1886, Appendix I.

Some doubt has existed as to whether the Chinese have not one or more kinds of plants in use as ginger that are unknown elsewhere. I have taken steps for collecting together and cultivating all the kinds of plants generally included by the Chinese as ginger with the hope that when in cultivation they can be studied and observed in such a manner as to secure all possible information in connexion with this subject.

While at San Ui I was fortunate in being able to obtain from cultivated plants good flowering specimens. These I dried, and together with specimens of the roots (properly rhizomes) forwarded to the Director of Kew Gardens for a study of them to be made there, where they can be compared with other kinds, or with specimens of the same kind from other places.

The specimens which I procured were, without doubt, *Zingiber officinale*, the species commonly in cultivation in other parts of the world.

It is, however, possible that some other plant, which is not a true ginger, may be used in making the celebrated Canton preserved ginger, but all the information which I have yet obtained points to the species *Zingiber officinale* as the only kind which the Chinese use for this purpose.

The ginger cultivated on the Lo-Fau Mountains has a wide reputation amongst the Chinese as being of unusual efficacy in medicine; this superior quality may, however, be derived merely from peculiarity of soil or climate, which communicate to the plant exceptional properties.

DR. H. A. ALFORD NICHOLLS, F.L.S., to ROYAL GARDENS, KEW.

Extract.

Dominica, West Indies,
July 5, 1890.

MY DEAR MR. MORRIS,

I HAVE succeeded in flowering the Chinese Ginger at Saint Aroment, and I send you a botanical specimen (taken from a shoot fully 4½ feet high) by this mail. You will be enabled from this specimen to determine the plant, and I hope I may be first in the field. I was really the first to get the Yoruba indigo to flower, but foolishly I did not send on specimens to Kew. I have other specimens of Chinese Ginger flowers pressing, and you can have them if you wish.

Yours, &c.
(Signed) H. A. ALFORD NICHOLLS.

SUPERINTENDENT, BOTANICAL AND AFFORESTATION DEPARTMENT, HONG KONG, to ROYAL GARDENS, KEW.

(*Extract.*)

Hong Kong, July 10, 1890.

DEAR SIR,

THE "Chinese Ginger" which you had at Kew, and sent to Ceylon, from which Dr. Trimen, at my request, sent me a piece about two years ago, has just flowered with me, and it is setting some fruit. It turns out to be *Alpinia Galanga*. I shall have more particulars to write about this when the fruit has matured, when I will write fully on the subject. Dr. Trimen informed me that it would not fruit in Ceylon.

Yours, &c.
W. T. Thiselton Dyer, Esq., C.M.G. (Signed) CHARLES FORD.

CLXXXIV.—PRODUCTION OF SEED AND SEMINAL VARIATION IN THE SUGAR-CANE.

Mr. Darwin sums up the results of many well-known observations when he remarks (The Variation of Animals and Plants under Domestication, Vol. II., p. 168), "Plants which from any cause grow too "luxuriously, and produce leaves, stems, runners, suckers, tubers, "bulbs, &c. in excess, sometimes do not flower, or if they flower do "not yield seed." As an example he gives (p. 169) the sugar-cane. This, "which grows vigorously and produces a large supply of succulent "stems, never, according to various observers, bears seed in the West "Indies, Malaga, India, Cochin China, or the Malay Archipelago."

No one has ever found the sugar-cane growing wild, and no one, says Alphonse De Candolle, in his well-known "Origine des Plantes Cultivées" (p. 125), has ever described or figured the seed. The late Mr. Bentham always spoke to me of the seed of the sugar-cane as a thing entirely unknown in herbaria. Hackel, the most recent authority on grasses, states in his recently published Monograph of the *Andropogoneæ* with respect to the seed of the sugar-cane, "cariopsin nemo adhuc "videsse videtur."

The experience of practical men has been to the same effect. Leonard Wray ("Practical Sugar Planter," 1848, pp. 29–33), discusses the question at great length. A few passages may be quoted.

"We often hear of 'cane seed,' and latterly a very earnest inquiry was set on foot with a view to decide the question whether the sugar-cane is really raised from seed in any part of the world or not, which terminated, I believe, in establishing the fact of there being no country known wherein the cane is, at present, raised from seed; whatever may have been the case in earlier ages."

* * * * * *

"The constantly recurring idea that canes are raised from seed in Egypt and the East Indies has kept alive a strong belief that the plant could be much improved by skilful cultivation and care, if this said seed could be obtained by European agriculturists. Hence numerous have been the endeavours, both private and public, which have been made to become possessed of it. The Royal Agricultural Society of Jamaica took up the subject, and exhibited much industry in collecting information; and, for aught I know to the contrary, may still be pursuing the inquiry."

* * * * * *

He finally arrives at the conclusion, "no variety of sugar-cane is "known to perfect its seed (or, indeed, to produce anything like seed), "either in India, China, the Straits of Malacca, Egypt, or even in the "South Sea Islands; as in all those countries the cane is entirely "propagated by cuttings." Lock, Wigner, and Harland (Sugar Growing and Refining, 1885), authorities nearly 40 years later, may be quoted to the same effect (p. 61):—

"It has more than once been stated that the sugar-cane is in some localities reproduced from seed, but the statement has originated in a misconception, there being no kind of sugar-cane known to regularly perfect its seed. Propagation is, therefore, effected exclusively by means of cuttings from the stems."

The number of varieties of sugar-cane in existence is considerable; in the Jamaica Botanic Gardens in 1884 there were 60 under experimental cultivation. The interesting question arises as to how they have originated. Looking at the fact that the raising of sugar-canes from seed has long been apparently unknown, the conclusion seems most probable that these varieties have slowly developed by the selection of what are known as bud variations. That is, a cultivator has noticed a cane in a clump which seemed to exhibit some advantageous difference from its fellows, and then by a repetition of the process, a distinct variety has ultimately been reached.

In 1886 a correspondence took place between Kew and the Colonial Office as to the measures which might be taken to improve the sugar-cane, as undoubtedly the sugar beet had been improved, by persistent analysis and selection. As to the desirability of the attempt, and the importance of the results which would flow from it if successful, there could be no matter of doubt. But an institution such as Kew can only advise according to the materials that exist for its scientific judgment. In the case of the sugar beet, the cultivator dealt with a plant which could run through its life in a comparatively short space of time, and could again and again be reproduced from seed. Taking advantage of the well-known principle of "seminal variation" year by year, an appreciable advance could be made towards the desired end. But in the case of the sugar-cane, there was nothing to indicate at the time, that anything of the kind could be done. All the evidence pointed to the fact that the sugar-cane had lost the power of producing seed. Under the circumstances, there was nothing but what is called "bud variation" to work upon. The advice given to the Colonial Office in this sense seems to have been transmitted to the several sugar-growing colonies, and to have been embodied in official notices. The following appeared in "The Barbadoes Agricultural Gazette" for August 1886:—

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

[*Extract.*]

Royal Gardens, Kew, May 13, 1886.

"Mr. Thiselton Dyer deems it advisable to direct the attention, not only of professional botanists, but also of planters, to the fact that new varieties in sugar-canes are to be sought in bud variation appearing accidentally in the cane fields, and that when such bud varieties are noticed, stock plants should be raised and carefully experimented upon until their value is fully known."

These announcements led to several communications being received at Kew with reference to the supposed seeding of the sugar-cane. Thus, in 1887, a correspondent in Fiji sent what he evidently believed to be the true thing, but which turned out to be Guinea cork (*Sorgham vulgare*).

The most important communication was, however, one from Mr. J. B. Harrison, the Island Professor of Chemistry and Agricultural Science at Barbados. This was dated September 17, 1888, and was published in the "Kew Bulletin" for December of the same year. For reasons which will appear in the sequel it is now reprinted.

Prof. HARRISON to ROYAL GARDENS, KEW.

Government Laboratory, Barbados,
17th September, 1888.

On certain of the higher districts of the island from time to time growths of sugar cane resembling fine grass have been noticed, but in most cases no attempts have been made to cultivate them. Mr. Parris some years ago succeeded in raising a few canes from the cane arrow or flowering shoot. Mr. Clarke did the same with the arrow of the purple transparent cane, but did not succeed in getting the seedlings to flourish, and my wife's father many years ago succeeded in getting the arrows to produce young canes, but not in cultivating them. Knowing these cases, Mr. Bovell and myself considered that a favourable opportunity of examining into this question offered itself during the cultivation of the varieties of canes which we have here. These canes were planted in rows of four broad by 25 feet deep, and so as to have two sets of each kind, in all 36 plots of 18 varieties, planted side by side. The plots were noticeable this year for the number of arrows sent up by some of the varieties. We gave strict orders to the labourers employed in weeding and watching the adjacent land to report to us any grasses springing up upon them in any way differing from the usual weeds. Towards the end of January they reported to us that a few tufts of grass different to the usual kinds were making their appearance. We found these to be growing in a rather narrow belt of the field on one side of the plots and in a little below it, following the direction of the prevailing wind. They were found not only on the surface of the field, but also on the bottom of a drain which had been dug in the field to a depth of 18 inches. Some 80 or 90 plants sprang up at intervals afterwards. We found a good deal of difficulty in keeping them alive, as the sun quickly shrivelled them up; it was necessary to protect them in many cases from the direct rays of the sun and to keep them constantly watered. In this way we succeeded in saving some 64 or 65 plants. Of these we carefully examined three or four so as to ascertain as far we could the absence of any particle of old cane in them. Their mode of growth was quite different to that of canes growing from the eyes of canes. Sixty plants were successfully transplanted, and are being cultivated. At present they are not far enough advanced in their growth to speak with certainty, but there appears to be amongst them several different kinds, probably five or six at the least. If you think it worth while, Mr. Bovell and myself will send you a specimen cane of each sort in January or February next, when they will be sufficiently far advanced to show their characteristics. The way in which they first grow is quite sufficient to account for them not being often noticed upon the fields. The weather here during January last was particularly favourable for their growth, and the fact of different varieties being grown side by side is, of course, much more favourable for the production of seed than the growth of one variety only. I have never heard of the Bourbon cane producing here fertile arrows; in all the alleged cases of fertility the arrows were either those of the purple or white transparent varieties which, as you are aware, are prone to variation. We shall again attempt this year to obtain the same results. I am anxious to have the benefit of your opinion upon this year's results, as of course, if we can establish the fact of the cane occasionally, and, under certain favourable conditions, producing fertile seed, it will open an important field of investigation.

J. B. Harrison.

The interesting discovery of Messrs. Harrison and Bovell gave distinction to the important work in the scientific investigation of the conditions of culture of the sugar-cane, which as far as I know alone in the Empire these gentlemen had for some years carried on at Dodd's Reformatory, Barbados. Attention had already been drawn to the "zeal and capability" with which this work had been prosecuted, in the "Kew Bulletin" for June 1887 (p. 9).

The importance of the discovery that it was possible to raise seedling sugar-canes, attracted a good deal of attention in the West Indies. Its practical significance was clearly summed up in an article in the "Demerara Argosy" for April 13, 1889. I extract the following passage:—

"From what we know of the great improvement that has taken place in other cultivated plants, through selection in seminal generation, the discovery can hardly prove other than important and beneficial. An improved variety on the best we now have may not be obtained, possibly for several years, but we may be confident that if the better kinds do, or can be induced to breed, with systematic attempts, carefully conducted to control the operation, and careful trial and selection of the progeny improved forms will in time result."

The same view was expressed in a letter from Kew to the Colonial Office, August 9, 1898, ("Kew Bulletin," 1889, pp. 242, 244).

"From the point of view of the sugar planter it is a fact which, if established and intelligibly followed up, is capable of effecting as much improvement in the sugar-cane and in its yield of sugar, as has been effected in the beet."

Scientific men are never content to accept a fact on mere statement. Before the seminal reproduction could be regarded as more than highly probable at Kew, it was necessary to see authentic specimens of the seeds from Barbados, and ascertain that plants of the sugar-cane could be raised from them. It is well known that grasses occasionally produce barren inflorescences, which bear vegetative bulbils instead of seeds, and as Messrs. Harrison and Bovell do not profess to be botanists, it would have been no discredit to them if they had been misled by such a circumstance. In fact, Dr. Fressanges of Mauritius, seems to have fallen into this error, to judge from the account given in the "Journal of Botany" for October, 1890, pp. 303–305.

This doubt was, however, dissipated by the receipt from them at Kew of portions of the arrow (flowering panicle) of the sugar-canes supposed to yield the seedlings. They were carefully studied by the Assistant Director, Mr. Morris, and I take the following account of the result from a letter communicated by him to the "European Mail" for August 20, of the present year.

"Some hundreds of spikelets were carefully examined, but it was only after a lengthened examination that a few seeds were found . . . Some of the seeds were sown under suitable conditions, and the whole process of germination carefully watched. Ultimately these observations were repeated over and over again during a period extending over several weeks "and at last the fact was fully proved by a series of microscopical "preparations, which definitely settled the matter, beyond doubt or "question."

As the matter had an important botanical besides a commercial side, Mr. Morris communicated the facts of Messrs. Harrison and Bovell's discovery and his own observations in confirmation to the Linnean Society on March 10. This paper with a plate was not published till December 15. A matter of so much interest was not likely to pass unnoticed. Some report of the paper, in no way authorised, circulated in the newspapers and ultimately reached the eyes of Mr. Harrison, who in the meantime, on the recommendation of Kew, had been promoted to another post in Demerara.

This led to the following communications being received from him.

GOVERNMENT CHEMIST, British Guiana, to ASSISTANT DIRECTOR, Royal Gardens, Kew.

Government Laboratory, Demerara,
August 28, 1890.

SIR,

MY attention has been called on many occasions lately by my friends in England to the many paragraphs which have appeared not only in the daily papers but in scientific ones, in which the whole credit of an investigation which you did not originate or in any way take part in is ascribed to you. As I believed that you would make an opportunity of correcting such mis-statements, up to the present I have not taken steps to publicly right Mr. Bovell and myself.

These statements originated in the Manchester press, have thence been copied and spread through the majority of English papers, and appear to have arisen from the paper read before the Linnean Society by yourself, in which judging only by the published accounts, while you gave us credit for growing self-sown seedlings you apparently omitted to mention the further stages of our investigation as detailed in our report for 1889 a copy of which you have received.

In the "Manchester Examiner and Times" of July 29th, appears a long article headed "Sugar Cane Seed (from a Correspondent)." In this article appear statements which are absolutely false, and which are so manifestly unfair to those who originated and carried out the investigation in question that I am forced to take notice of it.

I have therefore addressed a letter to the Editor of that paper which if he declines to publish I shall takes steps to have published and circulated. I enclose a copy of it for your information.

I may add that much indignation is felt in the West Indies by what is there considered your having tacitly allowed the credit due to the Java investigators and to Dodd's Experimental Station to be entirely ascribed to yourself.

Trusting that before you receive this letter you will have taken steps to correct these false impressions and so render the publication of my letter unnecessary.

I am, &c.
(Signed) J. B. HARRISON.

D. Morris, Esq., F.L.S.,
Royal Gardens, Kew.

P.S.—I have written the above and the enclosed letter entirely on my own responsibility, and have not consulted Mr. Bovell on the subject.

[Enclosure.]

To the Editor of the "Manchester Examiner and Times."

Government Laboratory, British Guiana,
August 22, 1890.

SIR,

MY attention has been drawn by friends in England to an article headed "Sugar Cane Seed (from a Correspondent)" which appeared in your paper under date of July 29th. As many of the statements in that article are absolutely untrue, I must ask you to kindly allow me space to correct them.

The statement that Mr. Morris, of Kew, has long held the opinion that there are seeds by which the sugar-cane could be grown, is strikingly at variance with his published ones. On the 12th May 1886, Mr. Morris wrote to the Colonial Office pointing out that as the sugar-cane did not produce seed, attention should be directed to bud variations which might appear accidentally in the fields. Next in a paper on the West Indies, read by Mr. Morris in March 1888, before the London Chamber of Commerce, that gentleman again stated that canes could not produce seed, and repeated his advice about bud variations. At that time we had at Dodds, seedling canes three months old, and the late Dr. Soltwedel, of Java, had proved conclusively in 1887 that the cane did produce fertile seed, and had published his results in the "Tydschrift voor Land."

Later in the year I received from Mr. Morris a copy of his paper, and after reading it, wrote to him on September 17th, 1888, on behalf of Mr. Bovell and myself, asking him if it was not somewhat indiscreet to commit himself to such a statement in the face of the fact that in Barbados many planters were satisfied that canes could be grown from seeds, that several instances existed in which canes had been grown from seeds, and also shortly describing the results obtained at Dodds.

This letter which we regarded, and still regard, as a private one, did not receive from Mr. Morris the courtesy of either acknowledgment or reply, but to our astonishment and indignation certain portions of it were published by him in the "Kew Bulletin" for December 1888. Our first intimation of this was by seeing the footnote headed "Seedlings of Sugar Cane" on page 11 of the "Times" Weekly Edition for December 1888.

In the notes added to our letter in the Kew Bulletin, Mr. Morris most carefully reserved his final opinion.

In our letter of September 17th, we asked Mr. Morris for the benefit of his opinion and advice, but have received neither advice nor assistance from him.

The next statement, that "under his instructions I buried the "flowering head of a cane in the ground," is absolutely false. No such instructions were ever given by Mr. Morris, and most certainly if I had buried a cane arrow in the ground no plants would ever have grown from it.

In January 1889, spikelets of the cane were stripped from the arrows by Mr. Bovell and sown. Of these many contained fertile seeds, which germinated and grew, and certain of the germinated seeds were preserved as microscopic objects.

On August 9th, 1889, Mr. Morris wrote to the Colonial Office asking to be supplied with seedling canes for experimental cultivation at Kew, and also pointing out the importance of obtaining specimens of what is known to be mature seed of the sugar-cane, and of placing such specimens for examination in the Kew Herbarium. He also under date of 16th October wrote to me stating that they "were very anxious to "obtain specimens of sugar-cane arrows *with seed* for the National "Herbarium," and asked for assistance in this matter "as soon as possible." In compliance with these requests, by the first mail in December 1889, we sent to Mr. Morris a bottle of cane spikelets containing, as we had already proved by germination experiments, fertile seeds, and at the same time to assist him in his examination of the spikelets we sent him specimens of seeds and of seedlings in various stages of germination which we had preserved in glycerine.

From the seeds which he thus obtained, Mr. Morris has raised seedlings, and has also described and figured the actual seeds. At the same time apparently he has tacitly allowed the credit belonging to an investigation which he neither originated nor in any assisted in to be entirely ascribed to himself.

But the question still remains, may not Mr. Morris have been the first to figure and describe the fruit of the sugar-cane? The answer to this question is emphatically, no.

In 1889, some months before Mr. Morris read his paper at the Linnean Society, Dr. Benecke of the Samarang Sugar Experiment Station had published a monograph entitled "Over Suikerreit uit Zaad" in which he not only published in some detail Dr. Soltwedel's researches, but fully described the fruit of the sugar-cane, and gave a series of illustrations of the seeds of the cane in their different stages of germination, and of the seedlings in the various stages of their development. I can vouch for the absolute accuracy of these drawings. Probably Mr. Morris had not received a copy of this work, which is written in Dutch, when he described the fruits of the sugar-cane for the first time in English, but if he had had one, it would have greatly assisted him in his work.

As a matter of fact, no new discovery has been made. Canes were successfully grown from seedlings in 1858 by the Honourable J. W. Parris of Barbados, and in 1860–61, were raised from the seed itself by Mr. F. P. Carter of that island. On account of the very low fertility of the seeds, and also of certain objectionable characteristics that arise in the canes (and which still characterise many of the seedlings raised at Dodds and elsewhere) the matter was allowed to drop by the planters. Whether or not any advantage will be gained by the use of the seed, is still a vexed question, as some authorities expect that the canes raised from seed may not contain as high a per-centage of sugar as those grown from the cuttings.

What has been done in this matter in recent years, is that to the late Dr. Soltwedel is due the credit of being the first (in recent years) to grow canes from seeds, but he appears to have ceased from his investigations as useless when he found that the seedlings were equally subject to disease as the canes grown in the usual way; to the Dodd's Experiment Station in Barbados, that of having worked out the method of successfully raising canes from seeds in large numbers, and of having shown the great tendency to variation which exists amongst canes so raised, and of having distributed large numbers of seedling canes and seeds through the West Indies and to Kew; to Dr. Benecke of having first described and figured the fruit of the sugar-cane; and to Mr. Morris that of having first grown canes from seeds in England, and of first describing and figuring the fruits in English. His work has doubtless done much to spread the knowledge of the fertility of the cane seed, but to allude to him as the discoverer of such fertility is not only grossly inaccurate but unfair to those scientists who have independently of him worked out that fact.

By his letters and writings previously to December 1888 [he] did far more to prevent, by discouraging research in that direction, the proof of the cane's seminal fertility than to assist in it.

I am, &c.
(Signed) J. B. Harrison,
Government Chemist, British Guiana,
formerly Island Professor of Chemistry
and Agricultural Science, Barbados,
and Natural Science Scholar of
Christ's College, Cambridge.

It is evident that Mr. Harrison thinks that he has been badly used by Kew. Nothing, it need be said, was farther from our intention or desire. And no doubt, had Mr. Harrison confined himself to private remonstrance it would have been easy to have satisfied him on that point. But as his view of the case has been communicated to the public prints, and practically amounts to a charge of bad faith against a member of the Kew staff, it seems desirable to record Mr. Harrison's claims along with the other facts of an interesting history.

A very few points in his letter to the "Manchester Examiner" seem to require a word of comment.

i. Mr. Harrison complains of the views expressed by Mr. Morris in official communications to the Colonial Office on the general subject of the improvement in the sugar-cane. It is only fair to say that these letters were written in my name and under my instructions, and that I am officially responsible for the views they express.

ii. Mr. Harrison complains of the publication of his letter of September 17, 1888, announcing the discovery of the seminal fertility of the sugar-cane in the Kew Bulletin for December, as he regards it as a private communication. I did not do so; I regarded it as an official communication from a Government official on a matter of very great importance, which had for some time engaged our attention, and I directed its publication.

iii. The accusation that Mr. Morris or any member of the Kew staff "tacitly allowed the credit belonging to an investigation which he "neither originated nor in any way assisted in, to be entirely ascribed "to himself" seems to me preposterous, in the face of the publication of Mr. Harrison's statements of his own results in these pages. The newspaper press of the United Kingdom is large, and no one can be held responsible for what is stated in it by unauthorised persons. Nothing whatever was known at Kew of the article in the "Manchester Examiner" nor down to this day do we possess a copy of it.

iv. What Mr. Morris, and for that matter Kew, has done in investigating the matter, is quite correctly stated by Mr. Harrison.

A copy of Dr. Benecke's pamphlet did not reach Kew till August 13, 1890. The history of Soltwedel's work is, however, given in such a convenient form in a letter from Mr. H. Winter, the former director of the Samarang Experimental Station, to Mr. George Stade of Berlin, published in the extremely useful journal, the "Sugar Cane," for December last, that I do not hesitate to reproduce it. Mr. Winter was "on the spot during most of the time when the experiments were being made by Dr. Soltwedel."

H. WINTER, Esq., to G. STADE, Esq.

DEAR SIR, Berlin.

You have asked me, with reference to the statements in the *Sugar Cane* for September, respecting the priority of the discovery of seed from the sugar-cane, to say a few words on the question. I am glad to respond to the request, as I was an eye-witness during several years of the attempts which were made at the Samarang Station in Java to grow canes from seed, and the first discoverer of the seed is now no longer able to speak for himself.*

Mr. Morris's supposition, that "the publication of the Java experi-"ments will probably now claim precedence over all others with which

---

* Dr. Soltwedel died December 17th, 1889, from syncope of the heart.

"we are at present acquainted," is quite correct. To the experimental station at Samarang belongs, not only the honour of having been the first to obtain seed from the cane and cane from seed, but also of having furnished the first detailed scientific description of the seed and the process of germination.

As regards the establishment of the first point, the fact does not appear to be as yet generally known that Dr. F. Soltwedel, at that time director of the experimental station in question, was already in possession of seed of the true sugar-cane a year before Messrs. Harrison and Bovell. At any rate, Mr. G. Dureau, in an article "Les Graines de Canne à Sucre" (*Journal des Fabricants de Sucre*, for 16th April 1890), makes no mention of this, and the editor of the *Sugar Cane* expresses himself doubtfully on the point. The following are the words of Dr. Benecke in his treatise "Over suikerriet uit zaad," being a summary of Dr. Soltwedel's original communication :—

As early as the spring of 1885, Dr. Soltwedel had commenced, at the Bendokerep factory at Japara, his investigations with regard to the fructification, principally of *Saccharum spontaneum*, L. (Glagah). He had observed that normal pollen grains were present in this species, which developed further on the pistil, and that fertilisation also took place resulting in the formation of actual seed. He had already succeeded, in 1885, in inducing these seeds* to germinate and obtained from them proper plants. In the same year Soltwedel was also engaged in studying the flowers of two varieties of *Saccharum officinarum*, L., viz., Tebce Cheribon (Java), and Teboe Poetih (Bendokerep). In this case he also met with perfectly developed flowers, but observed neither germination of the pollen grains nor fructification. Although the reports of other investigators offered little encouragement to seek for seed from the first-named kind, yet Dr. Soltwedel was impelled to do so by seeing bees flying so often to the tassels of this cane. He assumed from this fact that the latter must contain something that enticed the bees, and further reasoned that the plants must be furnished with this means of attraction for the benefit of their fructification. Hence he did not allow himself to be deterred by a series of unsuccessful experiments.

Dr. Soltwedel continued his observations in the experiment field at Samarang from April to July 1886. In this year also he failed to find any seed formation in any variety of the true sugar-cane, but in the case of *Saccharum Glonggong* (a kind of sugar-cane growing wild in Java, in the same manner as Glagah, and also not cultivated), seeds of which he induced to germinate, he obtained individuals which were exactly similar to the mother plant.

In the year 1887 Soltwedel finally attained his object. As he formerly observed in the case of Loethers, a variety very rich in sugar, fertilisation without formation of seed, he first of all tried to obtain seed by crossing it with a wild kind which produced seed. Here we cannot refrain from reproducing the original report of Soltwedel, which appeared in the *Tijdschrift voor Land en Tuinbouw, etc.*, of the 1st July 1887, in order to show how minutely he went into the question. He writes : "For the purposes of this experiment of cross-fertilisation "we this year selected Glagah and Loethers ; Glonggong was out of the "question, because this kind of cane does not come into flower until "Loethers has done flowering. But the endeavour to produce cross-"fertilisation is accompanied, in the case of the sugar-cane, with almost "endless difficulties, because of the extreme minuteness of the flowers.

---

* Dr. B. uses, instead of seeds, the more accurate botanical form "fruits."

"By the aid of very small anatomical scissors we endeavoured to cut
"away the, as yet, unopened staminal buds from a number of flowers of
"Glagah and Loethers. After so doing we put into the thus partially
"sterilised flowers of Glagha, pollen dust of Loethers and *vice versâ*."

As a matter of fact it was not possible to ascertain, later on, whether this cross-fertilisation had succeeded or not, however, almost at the same time, fertilisation was observed in the case of 20 varieties of the true cane other than the Loethers variety. Indeed in this year the formation of seed was also detected in nine different varieties. Soltwedel has given details of these in the following table :

VARIETIES OF SUGAR-CANE PRODUCING SEED.

Name.	Whence obtained.	Per-centage of Flowers which Formed Seed.	Weight of a Seed Grain in Milligrams.	Per-centage of Germinating Seeds.
Yellow cane	Hawaii	3·0	0·20	16
Teboe batoeng	Borneo	6·0	0·16	15
Teboe koening	Borneo	4·5	0·10	6
Branche blanche	Mauritius	31·0	0·15	35
Loethers	Mauritius	0·37	0·20	—
Teboe rapooh	Java	0·23	0·22	—
Teboe soerat balie	Java	0·36	0·20	—
Teboe soerat redjoe	Java	13·7	0·11	3
Teboe idjoe	Java	0·8	0·20	20
Glonggong	Java (wild)	8·5	0·16	—
Glagah	Java (wild)	24·0	0·34	—

"Thus, in a spikelet of Branche blanche we found the greatest number of seeds, out of 100 flowers there were 31 on the average which had formed one seed each. In the case of Teboe rapooh we found the fewest seeds, as there was only one seed to 435 flowers. The seeds are exceedingly small, those of Glagah being the largest, and those of Teboe koening and Teboe soerat redjoe the smallest."

A very large number of the seedlings perished ; only from the yellow Hawaii cane did Soltwedel (in 1887) obtain *strong plants which grew to 2½ metres.* In the year 1888 he divided these into cuttings, and obtained from them in the following year plants of 3½ metres high.

From what has been stated, there can be no doubt as to the man to whom belongs the honour of the discovery of the sugar-cane seed. Without wishing to hurt the feelings of the West Indian investigators or to diminish their universally acknowledged merits, we cannot help pointing out the difference between Soltwedel's successful striving for an object as to which he was certain, and (if we are to judge by the published reports) the more accidental discovery of Harrison and Bovell, and declaring that at least equal acknowledgment with that which they receive is due to the German investigator. As far back as 1887, Soltwedel was actually in possession of the seeds, whilst the Barbados investigators had in 1888 only arrived at a conclusion (which was still open to dispute) as to the existence of seeds from germinating cane plants, and indeed had probably only examined the pistil in the cane flower for seed, without being acquainted with the seed itself.

Further, besides Soltwedel, another planter in Java, Dr. L. Ostermann, had in June 1887 obtained seedling plants by sowing whole tassels in moist soil (Benecke, page 51). Afterwards a chemist named Schmitz, Dr. Ostermann, and more especially Dr. F. Benecke, obtained numerous plants by sowing isolated seed grains, the whole of which the writer had the opportunity of seeing.

I have already mentioned at the outset that the first scientific description of the sugar-cane seed had issued from the Samarang Station, in the shape of the pamphlet of Dr. F. Benecke, who was labouring there along with Soltwedel as botanist. This work, which Morris characterises as "a very clear and exhaustive account of the whole matter, illustrated by excellent drawings and dissections," was begun in May 1889, and finished somewhere about September of the same year. The translation (the MS. was written in German), execution of the drawings, and printing were surrounded with very special difficulties, so that the latter was not completed until January 1890.

So much towards clearing up the question as to priority of discovery. I may add, in conclusion, that in Java itself people do not attribute to the discovery of the seed that importance for the practical culture of the cane which they appear to do in the West Indies and other countries.

I hope I have met your wishes in this matter, and remain

Yours fraternally,
H. Winter,

As will be seen, opinions differ as to "whether or not any advantage will be gained by the use of the seed." An excellent account of what has so far been accomplished in British Guiana is given in the "Demerara Argosy" for November 1, 1890. This is worth reprinting, if only for the valuable observations it records on the seminal variation of the sugar-cane.

Seedling Sugar-canes.

The systematic propagation of the sugar-cane from seed is as yet in its infancy, nevertheless some facts of interest and importance have been discovered which are worth briefly summarising here. Since the time that the re-discovery, at Dodd's Botanical Station, Barbados, of the seminal fertility of the cane was authenticated, realising its potential importance, systematic experimental work has been carried on at our own Botanic Gardens, as our columns have before disclosed. That the very earliest varieties of sugar-cane can reach maturity the first year of their growth from seed has been shown as possible under favourable circumstances this season at the Botanic Gardens; though it must be admitted that even with these very earliest varieties both the proportion of canes in a stool and of plants to a bed of the same variety which flower the first year is small. Seed of the variety *Karakarawa*, which is one of the two earliest kinds in the Colony, was sown on 1st October last year. Three months later the young plants were taken from the seed boxes and pricked out in baskets, five or six in each basket. Six weeks later again they were shifted on singly into larger baskets, which were about six inches deep and wide, and in which they remained till they were from 1 to 1½ feet high, when, on the 19th April last, they were planted out in the open ground. At that time each plant consisted of a solitary shoot, none having begun to sprout from the base. A few weeks later, however, they began to tiller freely and to grow rapidly, and by the middle of September a few shoots of the more advanced plants were in flower, thus completing the cycle of growth. As, when they were planted out in the ground in April, the young plants were only in an equivalent stage to that of a cane top put into the ground at the same time, the record above given shows that seedling sugar-canes of the earlier varieties make rapid and vigorous growth once they get past the tedious period of infancy, which occupies from four to six months. Only, however, the very earliest varieties mature the first year; all the rest, though they may be only a month or so later in their period of flowering, miss the first season of arrowing, and consequently have to go on to the following autumn before the chance of performing that function occurs again; so that for the great majority of varieties it may be said that two years are required from the time the seed was sown for the seedlings to mature, or from 15 to 18 months from the time they were strong enough to be planted out in the open ground. This is a sufficient proof, if any were needed, that the idea of resorting to seed for propagation in field agriculture is impracticable, and that the present methods of propagation by cuttings or stumps will have to be adhered to in the future as in the past, if only for economy in time. But, of course, the insuperable obstacle to using seed in field propagation, even if time could be regarded, as the Indian regards it, as of no consequence whatever, is the delicacy and slow growth of the sugar-cane in infancy. In the climate of Guiana, field propagation of the cane by seed would probably not yield an average of one plant per acre. As we have emphasised before in these columns, the only useful way of employing the knowledge we now possess of the sugar-cane's seminal fertility, is in nursery propagation, with the object of obtaining new varieties. Of this method of propagation and its results we have now had two seasons' experience, and short as the period is over which the experiments have extended, the information gained is highly interesting and instructive. Numerous facts, naturally of varying importance and practical interest, have been discovered, two of which are of great value because of the promise they hold out of ultimate economic improvement in the sugar-cane by this method of propagation. The first of these important revelations is the wide variation that occurs in seminal generation in the sugar-cane; and the second the marked tendency to improvement shown in this variation. As was naturally to be expected there are numerous instances of retrogression, but the general tendency is clearly on the lines of improvement in each particular variety that has been so far successfully tested. The progress in improvement is gradual of course, and the degree naturally in direct proportion and relation to the character and quality of the parent canes. The inferior varieties, for instance, do not produce large varieties in a single generation, but as with better kinds, few or many of the progeny show a decided improvement on the parent stock. In the majority of instances the improvement, though evident, is not great, but occasionally an instance occurs that is a striking advance. This is the ground of encouragement in pursuing this method of reproduction. If among the seedlings of a variety is found in the first generation a plant twice or thrice the size of the parent plant, we are justified in expecting that by selecting this larger plant and breeding from it again we shall get still further improvement, to be repeated again and again in succeeding generations. This, we may note, is one of the points already achieved. By recording the name of the variety from which each lot of seed was gathered, when it was sown last year at the Botanic Gardens, this possibility of improvement has been established with certainty, so far as the evidence afforded by a few varieties in a single generation can be taken as a guide, and we know of no reason against its acceptance. We have mentioned the occasional improvement observed in size in the seedlings of these carefully recorded parent varieties; but the variation in colour and form and other external characters is more general and conspicuous than that in size. In the majority of instances there is an evident approximation in physical and morphological features to the characteristics of the parent, but the departure from this typical state covers the entire range of variation possible, from the least to the widest extreme. Of this wide range too many instances have occurred to leave any room for doubt on the ground of possible error of record as to parentage that might arise from mistakes made in gathering and sowing the seed, or in the subsequent course of growth. In many instances the variation is slight, but in several cases purely white or purely green canes have been produced by dark purple ones. We have said that in the majority of the seedlings there is a general approximation to parental likeness, but absolute likeness does not bear a very great proportion to the whole variation. The degree of approximation varies, however, in the different kinds, the smaller inferior canes producing a larger number like the parents than the larger and superior ones. Of one of the larger kinds of which many plants were raised, not one appears to have come absolutely true. This variety, called *Mani*, is a long-jointed claret-coloured cane, and the widest departure it has made in its varied-coloured progeny is to a short-jointed white cane. If this instance stood alone, as we have before intimated, it might be thought that a stray seed of some other kind had got into the stock, but, as we have also before intimated, the several instances of the kind that have occurred are too many to require or to justify resort to any such explanation. It seems not improbable in fact that if any one of the inferior varieties, possessing a fair degree of germinating power upon which success largely depends, were taken in hand, that by seminal propagation and careful selection from the seedlings, as many varieties, showing as wide a range of size, colour, quality, &c., might be procured from it in a few generations, as all the kinds of canes collected from all sugar-growing countries, which we now possess, show! This impression, gathered from our brief experience, justifies sanguine hopes of improvement in the future of the varieties we now cultivate, and imposes the obligation of zealous endeavour to realise this improvement. Another encouraging feature of seedling canes is that the features they first present appear not to be their best or permanent ones. During the first two years, at least, the period seedlings have been under observation here, there seems to be a steady general improvement in character. Where the first shoots have been slender, subsequent ones have come double the size, and where in the earlier canes the joints have been short and often bearded, in the later ones they have been long and clean, and a higher gloss and glow have also developed in the colour. So that as two full years are in most instances required for seedling canes to reach maturity, so also this period is necessary for them to develop their true character. The inference may be taken from this that if the cultivation of the seedling canes first discovered in Barbados had been extended, the objectionable features for which they were discarded and destroyed would have disappeared; in which case we should probably not now have to lament the loss in the experimental working of this potent discovery of the 30 years which have elapsed since that time. Though we have described the wide variation and improvement that might possibly be realised in a few years in breeding and selecting from one of the poorer varieties of cane, we have intimated as well that our object—that is obtaining an improved variety of cane to any now existing—would no doubt be earliest realised by breeding from the better kinds. The primary qualities required are—first, large size, to give weight of cane from the fields, and—second, sweetness to give yield of sugar from the canes. These may be regarded as the primary and absolutely essential qualities of a good cane, while it is admitted at the same time there are several important minor qualities, which, though dispensable, are also desirable. These pertain to the habit of growth, resistance to drought, earliness, flowering or non-flowering, degree of itch to the leaves, of fibre in the cane, &c., &c. In selecting breeding stock it must be admitted that we have much to learn on the subject of the transmission of qualities in seminal generation in the cane. We have described to some extent the evidence we at present possess of the considerable variation that takes place in descent in the physical and morphological features of the cane; whether the sweetness will vary to the same extent sufficient time has not elapsed yet for us to determine. This character is equally as important as that of the size and physical nature of the cane, and in our experimental work demands equal attention and regard. The few analyses it has been possible yet to make seem to point to the fact that external physical variation is accompanied by internal chemical variation. But we must wait another year, till our pedigreed seedlings have matured, before we can speak with assurance on this point. However, the uncertainty need not affect our present action; there can be no question, whether the saccharine quality varies or not in descent, the best stock to breed from is that possessing in largest degree the qualities, separately or combined, of weight of cane and of sugar. There are three possible ways in which we may look for improvement in the sugar-cane. We may obtain a variety that will give a larger weight of cane per acre, though it may contain no more sugar per ton of cane than the better kinds we possess now. Again, we may obtain a variety yielding a higher per-centage of sugar, though the weight of cane be not increased. This is what has been accomplished in regard to the sugar beet. Thirdly, we may obtain a cane containing both increased yield of cane and of sugar. Which would be the most desirable would depend upon the degree and relative proportions of bulk and per-centage of sugar in the cane. Sufficient has been said to show what is to be sought in propagating the sugar-cane from seed. We shall not get an ideal cane; but Mr. Neville Lubbock gave the writer one day a rough ideal toward which we may successfully strive. "What we want," said he, pointing to a plantain stalk 15 ft. high and as thick as one's thigh, "is a cane as big as that containing 20 per cent. of sugar." Whether we shall ever attain to the size of cane or degree of sugar contents just mentioned may be left to conjecture and the result of future work, but it is along the lines leading to those ends that we confidently look to make progress. The *Seard* seedling gives us an indication of what is possible. This is a plant of unknown parentage and fortuitous birth in Barbados. It was among the earliest natural seedlings discovered there by Messrs. Harrison and Bovell. When an inch or so high, and when nothing whatever could be known of its character beyond the facts mentioned, it was taken by chance from the nursery at Dodds by Mr. Bovell and sent here. It has turned out an entirely unknown variety, and a giant of its race. A few months ago it fell down of its own weight, when ten canes were broken off which collectively weighed 122 lbs. without the tops. In spite of this loss it is still 18 feet high and 12 feet in girth of stool, possessing 24 canes which will probably weigh when cut 200 lbs., half as many more having been killed by borers,—pests that have been unusually prevalent this year.

To sum up. Though the work done in Java undoubtedly anticipated that done in the West Indies by Messrs. Harrison and Bovell, it attracted but little general attention. The discovery of these latter gentlemen has been termed "accidental." Even if true, that is no demerit. Most discoveries in some sort are accidental. They often lie, so to speak, under our eyes, and only reveal their significance to those who are ready to appreciate it. This Messrs. Harrison and Bovell did, and the greatest credit is due to them for the fact. All that Kew has done in the matter was to put it on record and give it a scientific verification. For my part, I have no doubt, looking at the whole history of the improvement of cultivated plants, that the discovery, for so I think it, of Messrs. Harrison and Bovell has been the starting point of a new era in the cultivation of the sugar-cane, and with time and patience I do not see why even the aspirations of Mr. Neville Lubbock should not be realised. But it will require both.

At the moment of sending this paper to press I have received the following important communication from the Director of Forests and Botanical Gardens, Mauritius. It shows that the advice given from Kew in 1886, as to the possibility of effecting something for the improvement of the sugar-cane by taking advantage of "bud variation," though based upon theoretical considerations, was fully justified. I do not, however, pit one method against the other. I simply point out that the cultivator in quest of new varieties has, so to speak, two strings to his bow.

W. T. THISELTON DYER.

ROYAL BOTANICAL GARDENS, MAURITIUS, to ROYAL GARDENS, KEW.

The Gardens, Curepipe, Mauritius,
9th December 1890.

DEAR SIR,

* * * * * Raising canes from seed to get improved varieties will be a long and tedious affair, and there will be many disappointments before a really good hardy sugar-yielding variety will be obtained. I think it probable that more and better results will be obtained by good cultivation and by new varieties from bud sports. Of these last we have eight or nine in Mauritius alone, some of them are very fine canes and they are extensively planted. Most of them are hardier than their parents and yield more sugar. They are mostly obtained from new canes recently introduced. The sudden change of climate, soil, and other circumstances cause them to be thrown off. More of them might be obtained if the planters were more observing than they are, and closely followed the cane cutters when cutting the canes. Thus they would range all their fields over, perhaps, areas amounting to 1,500 acres, matching each cane as it is seen cut. As things are, a new variety is only observed should it chance to spring up in an outside row.

Yours, &c.
(Signed) JOHN HORNE.

W. T. Thiselton Dyer, Esq., C.M.G., F.R.S.

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 50.] FEBRUARY. [1891.

CLXXXV.—IPOH POISON OF THE MALAY PENINSULA.

Antiaris toxicaria, Lesch.

The use in the Malayan region of a vegetable poison to tip the bamboo arrows, which are discharged from a blow-pipe, is too well known to need description. To this the name *Upas* is given in Java, and *Ipo* by the Malays elsewhere. Both words have the same meaning, and, according to Blume, simply signify poison.

The properties and history of the Javanese *Upas* is the subject of almost a literature. There is no doubt that it is the produce of a tree, *Antiaris toxicaria*. The part used is the sap, which exudes when the bark is incised. It is contained in laticiferous vessels (milk-ducts) exactly in the same way as the milk of an india-rubber plant. According to Blume, the sap when drawn off undergoes rather an elaborate preparation before the blow-pipe arrows are tipped with it. But he expresses the probable opinion that the sap alone would be found equally deadly.

Its poisonous properties are, in fact, due to a definite chemical substance which has been extracted from it called *Antiarin*. Of this the following short account may be conveniently extracted from Watts' Dictionary of Chemistry:—

"Antiarin. ($C^{14}H^{20}O^{5}+2H^{2}O$.) The poisonous principle of the *Upas Antiar*, a kind of green resin which exudes from the Upas tree (*Antiaris toxicaria*), and is employed by the Javanese for poisoning

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
21, DRURY STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Twopence.

their arrows. It is extracted by exhausting the upas with boiling alcohol, evaporating to dryness after the antiar-resin (which is innocuous) has deposited, treating the extract with water, and evaporating to a syrup; the antiarin then takes the form of scales, which are purified by re-crystallisation. It is without odour, dissolves at 22°·5 C. in 251 parts of water, 70 parts of alcohol, and 2·8 parts of ether; the solution is neutral to test papers. It likewise dissolves in dilute acids. When dried at ordinary temperatures, it contains 13·4 per cent. of water of crystallisation, which it gives off at 112° C. It melts at 220° C. into a colourless liquid, which assumes a vitreous aspect on cooling, and at a higher temperature turns brown, and exhales acid vapours. Dehydrated antiarin contains $C^{14}H^{20}O^{5}$ (62·69 p. c. C. and 7·45 H.). Sulphuric acid colours antiarin brown. Hydrochloric and nitric acid dissolve it without alteration; so likewise do potash and ammonia.

"Antiarin applied to a wound produces vomiting, convulsions, diarrhœa, and soon afterwards death; its poisonous action is remarkably accelerated by a mixture with a soluble substance, such as sugar. (Mulder, Ann. Ch. Pharm. xxviii. 304.)"

It has long been known that a precisely similar use of poisoned blow-pipe arrows obtains in the Malay peninsula. And the tree which furnishes the material with which the arrows are tipped has been generally regarded as identical with *Antiaris toxicaria.* Half a century ago the distinguished Indian botanist Griffith collected the plant at Malacca, and remarks on the label of a specimen in the Kew Herbarium, "the small-leaved Epoo or Jackoon poison. *But* arsenic is said to be "mixed with the milk . . . otherwise . . . said to be inert."

In 1881, Sir Cecil Smith, now Governor, but then Colonial Secretary of the Straits Settlements, communicated to Kew a bottle of Ipoh poison as well as foliage specimens of the tree from which it was obtained. These were collected by Sir Hugh Low, then British Resident in Perak, at the Plus river. The poison was kindly subjected to a very careful examination by Dr. Sidney Ringer, F.R.S., Professor of Clinical Medicine at University College, who reported that it was perfectly inert.

The plant seemed identical with that collected by Griffith, and both were identified at Kew with the Javanese *Antiaris toxicaria.* Sir Joseph Hooker in the *Flora of British India* adopted the same conclusion.

In 1889 the Straits Government sent to Kew further specimens of Ipoh poison, which were again examined by Dr. Ringer with entirely negative results.

Botanists were not, however, unprepared for this result. The Dutch botanist Blume in his fine work *Rumphia* has given an elaborate account of the Javanese Upas and of the tree which yields it (pp. 46–59, tt. 22, 23). But he points out that Rumphius, our earliest authority on Malayan botany, distinguished two kinds of Upas trees, which he termed *Arbor toxicaria femina* and *mas* respectively. The words male and female when applied to plants in the East have no special meaning, and are little more than fanciful terms of discrimination. Rumphius's *femina* was destitute of any poisonous qualities, and Blume has described it as a distinct species under the name of *Antiaris innoxia* (Rumphia, pp. 171–173, t. 54). He received specimens both from the island of Timor where Spanoghe* found that the sap was destitute of any poisonous effect on animals; he also gives Celebes as a locality for the innocuous plant. Other botanists have not, however, found themselves able to attach much weight to the distinctive characters pointed out by Blume, and there can be no doubt that what weighed principally in his mind was the remarkable difference in the properties of the two forms. Species are, however, made by botanists on structural (morphological) differences and not on physiological. In the same species of *Cinchona* it is now known that there are the widest differences in the amount and even nature of the alkaloids which can be extracted from the bark. An equally striking, and even better known instance of difference in properties, unaccompanied by any difference in external characters, is afforded by two well-known British umbelliferous plants, *Œnanthe crocata* and *Cicuta virosa*, which Sir R. Christison found to be innocuous when grown near Edinburgh.

---

* Spanoghe's account of the (innocuous) Upas of Timor is printed together with that of Leschenauet on the virulent kind in Hooker's *Companion to the Botanical Magazine*, vol. i., pp. 308–317.

Kurz in his *Forest Flora of Burma* (vol. ii., p. 462), followed by Sir Joseph Hooker (*Flora of British India*, vol. v. pp. 537, 538), have combined the poisonous and innocuous forms under the older species *Antiaris toxicaria.*

Brandis in his *Forest Flora of North West and Central India* has identified with *Antiaris innoxia* the *Antiaris saccidora* of South West India. According to Beddome this is " the largest tree of the evergreen forests " of the western ghats, and the hills between them and the coast." Sacks are made of the thick woolly fibrous inner bark. The method is thus described by Graham :—" A branch is cut corresponding to the " length and diameter of the sack wanted, soaked a little, and then " beaten with clubs till the fibre separates from the wood. This done, " the sack formed of the bark is turned inside out, and pulled down, " until the wood is sawed off, with the exception of a small piece left to " form the bottom of the sack, which is carefully left untouched." It may be taken for granted that a bark which receives this amount of manipulation must be free from poisonous properties.

The identification with one and the same species of trees from widely distant localities, which have always been supposed to be distinct, is one of the uses of a large herbarium. Specimens of each can be readily brought under the eye at the same time for comparison.

Brandis remarks (*l.c.*, p. 427) :—" Another species of the same genus " is found in the dense evergreen forests of the Thoungyeen Valley. In " Tenasserim (*Myah seik*, Burm.), the juice is used by the Karens to " poison arrows, but the poison does not seem equal in its effects to that " of the famous Upas tree of the Indian Archipelago." Nothing more seems known of the tree which yields the Karen arrow poison, but it is very probably referable to *Antiaris toxicaria*. And Gamble (*Manual of Indian Timbers*, p. 332) refers the Burmese name *Myah seik* to that species.

The facts as they stand present a rather curious puzzle. There can be no doubt that in Java the Upas tree furnishes a very effective arrow poison. It may be inferred that its use originated in Java and some of the other Malay islands. Finding the same tree on the mainland the Malays used its juice. But they must have long since discovered that it is innocuous. According to Griffith they remedy this defect with arsenic. If this is really done it must be when the arrows are prepared; for two authentic specimens of Ipoh poison from the Malay peninsula were absolutely inert and contained none of the poisonous principle Antiarin.

The following correspondence gives the official history of the matter and the experiments in detail.

EXTRACT from LETTER from SIR CECIL C. SMITH to ROYAL GARDENS, KEW.

DEAR SIR, Singapore, August 25, 1881.

* * * * I am sending you a small bottle containing some of the poison "Ipoh," which the Malays use on their darts and spears. There are also some of the leaves, but I am sorry to say no flowers or fruit. We have got it through Mr. Low, who managed to obtain the specimens while travelling in the country * * * *

Yours, &c.

W. T. Thiselton Dyer, Esq. (Signed) CECIL C. SMITH.

Prof. SIDNEY RINGER to ROYAL GARDENS, KEW.

15, Cavendish Place, Cavendish Square, W.,
November 24, 1881.

MY DEAR SIR,

I SEND you a report of the experiments made by Mr. Stonham and myself with Ipoh. As you will see it is quite inoperative though we administered it in large doses.

Yours, &c.
(Signed) SIDNEY RINGER.

RESULTS of Experiments with "Ipoh."

1. Nov. 5, 1881.
Healthy frog: ½ c.c. of 5 °/₀ sol. injected under skin.
No effect.

2. Nov. 7, 1881.
Same frog as on Nov. 5th.
♏ x. of 20 °/₀ sol.
No effect.

Between experiments 1 and 2 this frog was kept under a bell jar on a table, and this in all probability accounts for the lethargy noticed.

3. Nov. 5th, 1881.
Healthy frog: 2.44 p.m., ¼ c.c. of 5 °/₀ sol.
2.53 p.m., ½ c.c. of 5 °/₀ sol.
3.3 p.m., ½ c.c. of 5 °/₀ sol.
3.10 p.m., 1 c.c. of 5 °/₀ sol.
3.20 p.m., 1 c.c. of 5 °/₀ sol.
3.55 p.m., ½ c.c. of 5 °/₀ sol.
No effect.

On Nov. 7th this frog was quite well, but a little lethargic.

4. Nov. 8th, 1881.
Healthy frog: 1 c.c. of 20 °/₀ solution.
No effect.

5. Nov. 8th, 1881.
Kitten, six weeks old.
♏ x. of 20 °/₀ solution.
No effect.

6. Nov. 14th, 1881.
Kitten, six weeks old.
♏ xiii. of pure Ipoh.
No effect.

Summary :—In all these experiments the drug was injected hypodermically. In none were any results obtained. Certainly the frogs were a little sluggish in their movements, but this was probably owing to their being kept on a dry surface without water.

Prof. SYDNEY RINGER to ROYAL GARDENS, KEW.

15, Cavendish Place, Cavendish Square, W.,
November 28, 1881.

MY DEAR SIR,

THOUGH the specimen you sent me is inert, no doubt *Antiarin* is a powerful heart poison, like digitalis, strophanthus, scillitin, &c., and its poisonous action is not due to arsenic, for the effects of antiarin on the heart are very different from those of arsenic.

Yours, &c.
(Signed) SYDNEY RINGER.

ACTING COLONIAL SECRETARY, STRAITS SETTLEMENTS, to ROYAL GARDENS, KEW.

Colonial Secretary's Office, Singapore,
September 17, 1889.

SIR,

I AM directed by the Governor of the Straits Settlements to forward the enclosed bill of lading and copy of a letter from the Resident Councillor of Malacca, regarding a box containing sap of the "Ipoh Kayu" and "Ipoh Akar," forwarded to your address by this mail, and to request that you will be good enough to examine and report upon the sap for the information of this Government.

I have, &c.
(Signed) A. M. SKINNER,
Acting Colonial Secretary,
Straits Settlements.

The Director, Royal Gardens, Kew.

RESIDENT COUNCILLOR, MALACCA, to COLONIAL SECRETARY, STRAITS SETTLEMENTS.

Resident Councillor's Office, Malacca,
September 7, 1889.

SIR,

I HAVE the honour to forward, for transmission to the Kew authorities, and for examination (A) a bottle of sap from the "Ipoh Kayu" (tree) [*Antiaris toxicaria*]; (B) a bottle of sap from the root of the "Ipoh Akar" (creeper).

2. I have procured these samples because the sap of the *Antiaris toxicaria* is spoken of in a letter from a London firm, quoted by the Director of Gardens and Forest, as a "strong poison," whereas a specimen from Perak was reported on some years ago as "innocuous," which

tallies with the information given me by the aborigines that it was not by itself poisonous, but was the vehicle for the other things mixed with it, among which is the sap of "Ipoh Akar," to form the blow-pipe arrow poison, respecting the preparation of which I communicated details when last in England to Dr. Rost, of the India Office.

I have, &c.
(Signed) D. F. A. HERVEY,
Resident Councillor.

The Hon. the Colonial Secretary,
Straits Settlements, Singapore.

DR. SIDNEY RINGER, F.R.S., to ROYAL GARDENS, KEW.

15, Cavendish Place, W.,
December 10, 1890.

DEAR MR. THISELTON DYER,

I AM very sorry so long a time has elapsed before sending you the report. The work was completed very shortly after you sent the material, but though I have often asked for the report I have not been able to get it from Mr. Bradford who made the experiments. I, however, saw them all, and so can report myself.

Mr. Gerrard, our dispenser at our hospital, a very able man, carefully examined the specimens* and could not obtain any body, either an alkaloid or glucoside, and came to the conclusion the substance must be inert. Mr. Bradford's experiments quite confirmed this conclusion.

Large doses were used without any effect; once we thought the heart after a very large dose was slightly affected, as digitalis affect the heart, but the effect was so slight and the dose so large that, practically, the substances may be pronounced inert.

Yours, &c.
(Signed) S. RINGER.

ROYAL GARDENS, KEW, to COLONIAL SECRETARY, SINGAPORE.

Royal Gardens, Kew,
December 15, 1890.

SIR,

I HAVE the honour to acknowledge the receipt of the Acting Colonial Secretary's letter of September 17, 1889 [Mal. $\frac{9590}{89}$] enclosing a copy of a letter from the Resident Councillor of Malacca, regarding specimens of Ipoh poison forwarded to me by the same mail.

2. These specimens were received at Kew. I was fortunate in inducing Dr. Sidney Ringer, F.R.S., Professor of Clinical Medicine, University College, London, to undertake their examination. He had been good enough to report previously on a sample of the same poison obtained by Sir Hugh Low, British Resident at the time in Perak, and transmitted to Kew in 1881 by the present Governor of the Straits Settlements.

3. I have, recently, reminded Professor Ringer that I had not received any report for transmission to you of the results of the examination he had so kindly undertaken. He has expressed his regret to

---

* Dr. Ringer informs me that *both* specimens were examined, and both proved inert.

me at the delay, but informs me that the work was completed under his supervision shortly after the receipt of the material. Professor Ringer, however, has never succeeded in obtaining from the gentleman who made the experiments a detailed report upon them. He has now been so good as to furnish me with the results as observed by himself.

4. A chemical examination of the substance failed to show that it contained any alkaloid or glucoside, and the conclusion was, therefore, arrived at that it was inert. Physiological experiments entirely confirmed this view, as large doses were used without any effect. This entirely confirms the results obtained in 1881.

5. The inertness, which now seems to be established, of the Malayan Ipoh is certainly very remarkable if it is really derived from the Upas tree (*Antiaris toxicaria*). There can be no doubt that, at any rate in Java, the sap of that tree yields a very powerful heart poison. It is possible that the Upas of the Malay peninsula is an innocuous race, different from that of Java. I propose to discuss the whole subject in an early number of the *Kew Bulletin*.

I am, &c.
(Signed) W. T. Thiselton Dyer.

Sir J. F. Dickson, K.C.M.G.

CLXXXVI.—KATH, OR PALE CUTCH.

In the *Kew Bulletin* for October, 1889, an account was given of the source and manufacture of *Gambier*. This is sometimes called *Pale Catechu*.

It must not be confounded with a substance manufactured in India from an entirely different source, namely, the wood of two species of *Acacia*, *A. Catechu*, and *A. Suma*. This is called *Cutch*, or *Black Catechu*. Its composition is very similar, however, to that of Gambier.

The latter, when met with in commerce, is an earthy-looking light brown substance, consisting of cubes about an inch each side, more or less agglutinated. Cutch, on the other hand, is met with in dark brown masses, hard and brittle on the surface and at first softer within. It breaks easily when dry with a shining granular fracture.

It is, however, curious that there is a form of Cutch which a good deal approximates to Gambier. This is called *Pale Cutch;* and it is the subject of the present article.

The excellent Dictionary of the Economic Products of India which is in course of publication by Dr. George Watt, under the authority of the Government of India, gives the following account of the mode of preparation of ordinary Cutch (vol. i., pp. 29, 30):—

" At the present day, by far the most important product of *Acacia Catechu* is the resinous extract (Catechu) obtained by boiling down a decoction obtained from chips of the heartwood. The practice of preparing this extract has been handed down from remote periods. The Sanscrit authors mention the drug, and Barbosa, in his description of the East Indies published in 1514, mentions what is, in all probability, this drug under the name *Cacho*. He states that it was at that time exported from Cambay to Malacca. *Cacho* is apparently the Kanarese word *Káchu* now applied to it. It is in fact probable that the word Catechu is a modern Latin derivative from the South Indian name, and that from South India the product was first exported. Some authors, however, say that it is derived from the Cochin Chinese word *Caycau.* One of the Tamil names for the plant is *Kati*, *Kuti*, or *Cate*, and the second half of the word may have been derived from *Chuana*, to drop or distil. Whatever may be the origin of the word Catechu, it would save much ambiguity if it could be restricted to the extract from *Acacia Catechu* instead of being made popularly to include one or two other substances such as Gambier, a word of Malayan origin signifying bitter, and applied to a purely Malayan product (*Uncaria Gambier*). It is quite true that both these astringents contain the same chemical properties, but they are obtained from widely different plants and manufactured in countries separated from each other. In our *Trade and Navigation Returns* the exportation appears as 'Cutch and Gambier,' from which one would naturally infer that both Cutch (or Catechu) and Gambier were exported from India, the relative proportions of which had not been determined. I am informed, however, by my friend Mr. J. E. O'Conor that this practice is a remnant of the time when the Straits Settlements returns were published with those of India. At present, therefore, by 'Cutch and Gambier' is meant in all probability chiefly Catechu; a small amount only of Gambier is re-exported."

The physical characters of ordinary and Pale Cutch are contrasted by Dr. Watt as follows (l. c., p. 35):—

"Commercial Catechu occurs in great masses, surrounded by leaves or broken into small blocks, in balls, cubes, or irregular-shaped pieces. In colour it is externally of a rusty brown, internally a dirty orange to dark liver colour—in some cases almost black, in others port-wine coloured. It is inodorous, with an astringent and bitter taste, followed by a sense of sweetness. It is brittle, and breaks with a fracture more or less resinous and shining. The pale form *Kath* is grey-coloured, porous, and under the microscope is seen to be composed of agglutinated masses of needle-shaped crystals.

"Kath, or Pale Catechu, is the restricted name given in Northern India to a grey crystalline substance prepared from a concentrated decoction of *Acacia Catechu* wood by placing in it a few twigs and allowing the decoction to cool. The twigs are removed, and the crystalline substance collected. Whether the liquid is rejected, or afterwards boiled down to produce a poor quality of dark Catechu or Cutch, has not been ascertained. As sold in the bazaars this crystalline substance occurs either in irregular pieces or in square blocks similar to the dark orange-brown homogeneous cubes of Catechu. This is the substance eaten by the natives in their *pán*, and which imparts with lime the red colour to the lips. It is, apparently, never exported to Europe. *Kath* and Cutch have by Europeans been mistaken for the same substance, but the former is much purer, chemically, than the latter, and it may be owing to the fact of Cutch being the form exported to Europe, that Catechu has lost the former position it held as an astringent medicine. It seems probable that the preparation of *Kath* may be a secondary process from the Cutch, since its direct preparation from the original decoction has only been observed at Kumaon, although the substance is universally used in *pán* all over India. This subject deserves to be thoroughly investigated, and the merits of *Kath* and its process of preparation made known.

"The process of preparation of *Kathá* or *Káth* is described by Madden:—

"'One portion of the Khairis is constantly employed in cutting down the best trees, and for these they have to search far in the jungles; only those with an abundance of red heartwood will answer. This is chopped into slices a few inches square. Under two large sheds are the furnaces,—shallow, and with a slight convex clay roof pierced for twenty ordinary-sized earthen pots. This operation takes place in about an hour and a half. The liquor resembles thin light port, and the *Kathá* crystallizes on leaves and twigs thrown into it for the purpose. Each pot yields about a seer of an ashy white colour. The work is carried on for twenty out of the twenty-four hours by relays of women and children; the men merely preparing the wood, which, after being exhausted, is made use of as fuel.'"

Fluckiger and Hanbury (Pharmacographia, pp. 242, 243) give the following account of Pale Cutch as the result of their own researches:—

"In Kumaon, in the north of India, a slight modification of the process affords a drug of very different appearance. Instead of evaporating the decoction to the condition of an extract, the inspissation is stopped at a certain point and the liquor allowed to cool, 'coagulate,' and crystallize over twigs and leaves thrown into the pots for the purpose. How this drug is finished off we do not exactly know, but we are told that by this process there is obtained from each pot about 2 lb. of '*Kath*,' or Catechu, of an ashy whitish appearance."

"The Pale Cutch referred to as manufactured in the north of India is in the form of irregular fragments of a cake an inch or more thick, which has a laminated structure and appears to have been deposited in a round-bottomed vessel. It is a porous, opaque, earthy-looking substance of a pale pinkish-brown, light and easily broken. Under the microscope it is seen to be a mass of needle-shaped crystals exactly like Gambier, with which in all essential points it corresponds. We have received from India the same kind of Cutch made into little round cakes like lozenges."

The following documents give the most recent information on the subject:

INDIA OFFICE to ROYAL GARDENS, KEW.

India Office, Whitehall, S.W.,
17th January 1891.

SIR,

I AM directed by the Secretary of State for India in Council to forward to you the enclosed copy of a Memorandum by Dr. H. Warth, of the Geological Survey of India, on the preparation of *Kath* from the wood of Acacia Catechu. Viscount Cross hopes it may be considered of sufficient interest for publication in the *Kew Bulletin*.

I am, &c.
(Signed) A. GODLEY.

W. T. Thiselton Dyer, Esq., C.M.G., F.R.S.,
Director, Royal Gardens, Kew.

[Enclosure.]

MEMORANDUM on the preparation of Kath, or Pale Catechu.

In Dr. Watts' Dictionary of the Economic Products of India we find it stated that the merits and the preparation of Kath deserve to be thoroughly investigated.

As I have had occasion to study the subject and to make experiments, it may be useful to record the following facts:—

The Kath of the North-west Provinces which is used with pán and the Catechu of Burma which is exported to Europe as a dye stuff are both prepared from the wood of *Acacia Catechu*. The Kath is in its purest state chiefly catechin, a crystallizing substance, nearly insoluble in cold water. The Catechu is chiefly catechu tannin, a substance soluble in cold water and not crystallizing, but some catechin is usually mixed up with it. The difference between Kath and Catechu is partly due to the methods of manufacture, partly to the difference in the trees.

The trees in Burma differ from those of the North-west Provinces, and at each place there are two kinds of trees, No. 1 and No. 2, although of exactly the same species. Trees No. 2 have white spots in the wood, caused by a white substance stored up in cylindrical masses half a millimetre thick and 10 millimetres long. Trees No. 1 have no white spots. Trees with spots yield an extract richer in catechin, and both kinds of trees in the North-west Provinces yield more catechin than the corresponding kinds in Burma.

I found the following proportions of catechin in the total extract:—

	Catechin.
Burma, No. 1 - - - -	14 per cent.
„ No. 2 (spotted) - - -	30 „
North-west Provinces, No. 1 - -	36 „
„ „ No. 2 (spotted) -	40 „

The greatest amount of extract obtained from each kind of wood was as follows:—

	Extract.
Burma, No. 1 - - - -	17 per cent.
„ No. 2 (spotted) - - -	18 „
North-west Provinces, No. 1 - -	14 „
„ „ No. 2 (spotted) -	24 „

The greatest amount of catechin obtainable from these woods is accordingly as follows:—

	Catechin.
Burma, No. 1 - - - -	2 per cent.
„ No. 2 (spotted) - - -	5 „
North-west Provinces, No. 1 - -	5 „
„ „ No. 2 (spotted) -	9 „

Such a great proportion of catechin in the spotted wood of the North-west Provinces explains that Kath manufacture is at home there. Moreover, the local Kath makers are reported to refuse as unfit all trees which do not contain white spots, so that the trees No. 1 become wasted in the forests.

I determined the catechin by direct separation as follows. About two ounces of the wood reduced to thin shavings were boiled with 20 times their weight of water for half an hour. The extract was separated from the wood by repeated settlement, and reduced in bulk on the water bath until it just began to thicken, and contained by estimate 6 per cent. of catechin. It was then left to stand in a cool place for five days for the separation of the catechin. Once the catechin had separated, the liquid could again be diluted with cold water for the purpose of filtering. The filtered and roughly washed catechin was dried at ordinary temperature, and weighed in a thoroughly air-dry condition.

The high degree of concentration and the long standing are required because the catechin separates with difficulty out of an extract which contains so much Catechu tannin. Once the bulk of the tannin is separated, the catechin may be dissolved in much more water, and it will separate immediately on cooling, but the catechin is at all times a delicate substance, which changes with water slowly into a soluble substance, and is thus lost. The drying of the moist catechin must take place at a low temperature, as heat at once destroys the microscopic crystals.

The manufacture of Kath, or raw catechin, is carried on in the forests with very primitive appliances. The filtering is done through layers of sand, and much sand becomes mixed up with the Kath. The drying is performed in the open air.

The people say that they possess a manufacturing secret, but there seems no need for one, unless their secret consists in the mixing of some finished catechin with the thick liquid, which sometimes promotes the separation of the new catechin. Anyhow, I made out of the 50 lbs. of *Acacia Catechu*, No. 1, from the North-west Provinces, nearly 2 lbs. of pure catechin, and it is from this wood that the Kath makers of the North-west Provinces declared themselves incapable of making Kath. For filtering larger quantities of catechin I found the filtering press an excellent expedient. The pressed catechin dried in a few days from simple exposure to the air, and once dried the catechin is a very durable substance.

Contact with iron must be scrupulously avoided during the extraction of catechin. With Catechu or Cutch contact with iron is of no consequence, and the reports mention iron caldrons in use for the final boiling down of the Cutch in Burma.

The preparation of Cutch or Catechu is of course simpler than that of Kath, because nothing but watery extraction of the wood is required, and subsequent boiling down of the extract.

After a certain degree of concentration a skin forms over the surface of the hot liquid, and constant stirring for hours is required to effect the final dessication. This long stirring process is also mentioned, but not explained, in the descriptions of the Burmese Catechu extraction. In modern dye extraction works the stirring would be avoided by the use of vacuum pans.

H. Warth.

December 1890.

As pointed out by Fluckiger and Hanbury (Pharmacographia, p. 337), Pale Cutch and Gambier agree in composition, both consisting mainly of Catechin (Catechucic acid). This is readily soluble in hot water, but much less so in cold; it is therefore deposited in a crystalline form from its concentrated aqueous solution on cooling. This accounts for the close similarity in the mode of preparation of both Pale Cutch and Gambier. The object of all the various details of the native methods of preparation is obviously to induce crystallization when the critical point of concentration has been reached.

Ordinary Cutch contains in addition to Catechin, Catechu-tannic acid, and the presence of this substance "Catechu-tannin," according to Dr. Warth, impedes the separation of the Catechin in a crystalline form.

It is remarkable that Pale Cutch does not appear to be met with in commerce. As it so closely agrees with Gambier, which is now in great demand, it would be probably readily accepted by tanners as a substitute.

CLXXXVII.—PRODUCTION OF CANE-SUGAR IN THE SUGAR-CANE.

The sugar-cane will no doubt have, even when bounties are withdrawn, still to compete on no unequal terms with the beet. It is obvious, then, that no pains should be spared to increase its productiveness in cane-sugar. Yet it is remarkable how little has been done to thoroughly investigate the life-history of the sugar-cane, and to ascertain the most favourable conditions for the formation of cane-sugar in its tissues. The only place at present in the British Empire where any scientific study of the sugar-cane has been made is at Dodd's Reformatory, Barbados, where, as pointed out in the *Kew Bulletin* (1888, p. 295), "cultural and chemical experiments with various kinds of sugar-canes" have been made, and the results published by the Government. But considering the importance of the subject it is a matter of regret that our knowledge of what may be called the internal economy of the sugar-cane is far inferior to that which has been obtained in the case of a much more intractable plant, the beet.

The great desideratum with the sugar-cane, as in the past with the beet, has been to increase its productiveness in cane-sugar. The last word on the subject is the statement of Mr. J. R. Bovell, the Superintendent of Dodd's Reformatory, in his most recent report:—"No "information has yet been obtained with regard to increasing the "richness of the canes, either by the manures or by growing them from "portions of the cane rich in sugar."

The problem of the accumulation of cane-sugar in a plant is a somewhat obscure one. The purpose of this article is to draw attention to the slender information which we have about it. Cane-sugar is one of a large number of chemical substances which play a most important part in the life of plants. They are called carbo-hydrates because they are composed of the three elements, carbon, hydrogen, and oxygen, the two latter elements being present in the same proportions as they exist in water.

Starch, from the botanical point of view, is the primitive carbo-hydrate. The whole series of substances found in the plant, which, in their ultimate constitution, are found to conform to the carbo-hydrate type, undoubtedly derive from starch by virtue of chemical changes brought about, for the most part we know not how, within the plant organism.

Starch is manufactured in the leaves of plants from carbonic acid absorbed from the atmosphere and from water supplied by the plant. The superfluous oxygen is returned to the atmosphere. Hence we get a rough justification of the term carbo-hydrate; carbon may be regarded as welded together with the constituents of water, though this is not an altogether accurate description of the process by which starch is produced. Roughly, the passage of starch, and its more intractable analogue cellulose into sugars of various composition may be regarded as a variation in the proportions with which the constituent carbon is combined with water.

Starch, as has been said, is formed in the leaves. It supplies materials from which all the solid parts of plants are built up. It must therefore, in some form or other, be capable of transport from the part of the plant where it is being formed to the part of the plant where growth is taking place. Now starch is not a very soluble substance, and we know that the materials which sustain the growth of plants can only be distributed through their structures in the soluble form. Starch, having been once formed, is practically locked up as long as it remains starch. To be available for the purposes of plant-growth it is necessary, for the most part, that it should be converted into a soluble sugar.

One of the most striking changes of this description is that which takes place in the germination of starchy seeds. The process of malting is only an arrested germination. The seeds of barley are allowed to germinate sufficiently to convert all their starch into starchy sugar, or maltose. The reason of this is that maltose can be made to yield alcohol by fermentation, while starch cannot. Now, the conversion of starch into maltose is effected by one of a peculiar class of bodies, called ferments, whose very composition and mode of action is still imperfectly understood. In the case of starch the conversion into maltose is effected by a ferment called *diastase*.

But a ferment of the nature of diastase is, there is reason to believe, very widely distributed in plants, and is by no means confined to the seeds of barley. Diastatic ferments have been found in leaves and shoots, and it seems probable "that a ferment of this kind is present in all living plant cells." Few things have been more carefully investigated than the chemistry of malting, and it might be supposed that the chemical results of the change by which starch is converted by means of a diastatic ferment into a soluble sugar would be thoroughly understood. This is, however, far from being the case.

There can be no doubt that in the case of germinating barley the resultant is maltose. This is not, however, apparently, much met with in plants. What is met with is a substance of simpler constitution, called variously glucose, dextrose, or grape sugar. It is "widely distributed throughout the vegetable kingdom, being especially abundant in the juice of ripe sweet fruits—the name grape sugar being derived from its occurrence in considerable quantity in ripe grapes." If a chemist is asked as to the origin of glucose he can give no satisfactory reply.

It appears that diastase has no further effect on starch-sugar after it has produced it from starch, but that dilute acids have; and as dilute acids abound in plants we can easily understand that the starch in plants may yield starch-sugar, and that this may in turn be broken up as fast as formed. Here, however, the chemists fail us; they have not yet made up their mind as to what is the exact result of the action of dilute acids on starch-sugar.

"Although," remark Armstrong and Groves, "there can be little doubt that the final product of the action of acids on starch is not merely sucrodextrose [glucose], as has been very generally supposed, it must be admitted that at present there is not sufficient evidence as to what is exactly the nature of the product."

Still, though chemists can give no satisfactory theoretical account of the origin of glucose in the plant, it is a substance only second in importance to starch, of which there cannot be the smallest doubt, from the chemical point of view, that it is the direct derivative.

Leaving glucose for a moment, we may turn our attention to cane-sugar. While the former is a migratory product, destined to afford material for the building up of tissues, the latter, as Sachs correctly points out is a "reserve-material" stored up for some future effort of growth on a large scale, such as the process of flowering. Yet it is singular that it is twice as soluble as glucose. Nevertheless, glucose seems to be what may be called the sugar "currency" of the plant economy, and cane-sugar only the "bullion" or banking reserve. The botanist is quite clear as to what happens in a cane-sugar plant. This is Sachs' account:—"Starch is assimilated in the leaves of the Beet; in the petioles it is found again in the form of glucose. This glucose now enters the growing and swelling root, and is transformed into cane-sugar in its parenchyma." The parallel processes in the sugar-cane seem to have been little studied. The following note is therefore reprinted from the Proceedings of the Agricultural and Horticultural Society of India for July 1890:—

NOTE ON GROWTH OF SUGAR-CANE.

Mr. Criper presented the following suggestive note on the growth of sugar-cane :—

I am enabled, by the kind permission of Mr. Macalister of the Rosa Sugar Works, to place some analyses made by me at that place, before the Society, illustrating the gradual formation of sugar in the sugar-cane, at different periods of its growth.

The cane was analysed in July, September, and November. The three joints at the bottom of the cane, and the three at the top, just below the commencement of the leaf, were taken for analysis, the middle joints being left.

ANALYSES OF CANES AT DIFFERENT PERIODS OF THEIR GROWTH, SHOWING THE PROGRESS OF RIPENING.

1st Analysis.—July 31st.

Height to end of leaves - - 8 feet.
" beginning of leaves - - 3 "
Weight of cane, whole - - 11 chittacks.
Cane only - - - - 7 "

—	Top 3 joints.	Bottom 3 joints.
Cane-sugar	nil.	2·00
Glucose	1·28	1·60
Ash	·96	·73
Cellulose	6·00	13·95
Organic matter soluble	1·68	·69
Acid (acetic)	·22	·06
Water	89·86	80·97
	100	100
Total juice	94 per cent.	86 per cent.

ANALYSIS OF CANES.

2nd Analysis.—September 12th.

Height of cane to end of leaves - 9 ft. 6 ins.
" " beginning of leaves - 5 ft. 4 ins.
Weight of cane only - - - 10 chittacks.
" whole - - - 14 "

—	Top 3 joints.	Bottom 3 joints.
Cane-sugar	nil.	8·00
Glucose	2·69	1·03
Ash	·88	·69
Cellulose and Albuminous matter	10·82	15·09
Acid	·09	·06
Water	85·52	75·13
	100	100

3rd Analysis.—November 7th.

Length of cane to end of leaves	12 feet.
,, ,, beginning of leaves	8 feet.
Weight of cane, whole	1 seer 7 chittacks.
Cane only	1 seer.

—	Top 3 joints.	Bottom 3 joints.
Cane-sugar	nil.	8·00
Glucose	2·12	·16
Ash	1·12	·83
Cellulose - Albuminous matter	15·54	21·19 { Cellulose - 17·92 Sol. organic matter - 3·27
Acid	·06	·07
Water	81·16	69·75
	100	100
Total juice	—	82 per cent.

From the above analysis it will be noticed—

1st. That the top joints contain no cane-sugar in November when nearly ripe.

2nd. That glucose is invariably present, being highest in September in the top joints, and lowest in November in the bottom joints, *i.e.*, when the cane is about ripe.

3rd. The top joints contain about 10 per cent. more water than the bottom ones, and this ratio does not appear to alter during ripening.

4th. The amount of water present is from 8 to 11 per cent. more in July than in November.

Analyses of cane-juice at different periods gave the following results:—

—	1st Analysis, Aug. 31st.	2nd Analysis, Sept. 29th.	3rd Analysis, Dec. 10th.
Height of canes to commencement of leaves.	4½ ft.	5½ ft.	6½
To end of do.	9 ft.	10½ ft.	10½
Specific gravity of juice	1·037	1·04	1·071
Cane-sugar	4·25	8·00	16·00
Glucose	1·27	2·00	·31
Ash	·73	·78	·73
Albuminous matter	1·51	·89	3·25
Acidity	·16	—	—
Water	92·08	88·33	79·71
	100	100	100

The rise in the amount of albuminous matter, and decrease in the glucose, between September and December is particularly noticed

It appears probable that the plant organism effects the conversion of the glucose into cane-sugar by combination with the elements of water.

The foregoing shows how wasteful is the practice common in some parts of India, of reserving whole canes for seed purposes instead of utilising only the upper portions of the plants, the West Indian method, as pointed out by Mr. Goodridge (*see* the Society Proceedings, September 1885), " The West Indian planter would consider it pure waste to use " his mature cane for seed [planting] . . . the tops are carefully " cut off, the stems and blades are used as fodder, and the cane tops, " about a foot long, are carefully preserved in trash, till the time for " sowing arrives." Mr. Goodridge remarked that besides saving the mature cane for the mill the use of tops for planting had other considerable advantages which he pointed out.

In connexion with the subject, the following extract from a note by Mr. J. J. Willis in the *Gardener's Chronicle* for the 12th July is of interest :—" In experiments at Rothamsted with the sugar-yielding root " crops, it was found that there was more sugar produced the larger the " amount of nitrogen applied as a manure, although not in proportion " to the amount supplied. Also that the efficiency of a given supply of " nitrogen is greatly dependent on the available minerals of the soil. " Taking the mean of many investigations in which potash formed an " ingredient in the manurial supply, it was found that 1 lb. of nitrogen " in manure yielded 20 lbs. of sugar."

From the very remarkably research of Brown and Morris " on the germination of some of the Gramineæ," in the process of malting the conversion of starch into cane-sugar appears to be syncopated and the glucose stage to altogether disappear. It should be explained that in the seed of the barley there is a large store of starch external to the embryo. The latter grows at the expense of this store, and of course to feed it the starch has to be converted into a sugar.

The authors state :—" We cannot avoid the conclusion that transformed starch is absorbed from the endosperm by the columnar epithelium of the embryo in the form of *maltose*, and that this maltose, by " the more or less complicated metabolic processes of the living cells of " the embryo, is rapidly converted into *cane-sugar*."

" We have been able to demonstrate in a very striking manner the ability of the growing tissue of the embryo to convert maltose into cane-sugar. This was done by cultivating the excised embryos of barley upon a solution of maltose, and determining the cane-sugar in the plantlets after such cultivation. Although under these circumstances cane-sugar may be found within the embryo, not a trace can be discovered in the culture medium itself, which we should expect if the maltose were converted by the action of any secreted ferment."

" When, on the other hand, embryos are grown upon solutions of *dextrose* [glucose] instead of maltose, no cane-sugar is formed in their tissues."

Their researches further point to the conclusion which botanists are quite ready to accept, that cane-sugar is the diffusible carbo-hydrate which is most easily reconverted into starch and therefore cellulose. The object of the sugar-cane and of grasses generally in storing up a large quantity of cane-sugar in their tissues is to provide for the great demands of flowering and the subsequent maturation of the seed. That the sugar-cane has for the most part become sterile in cultivation does not affect the point ; the physiological habit remains, though the ultimate purpose has been abandoned. Brown and Morris point out clearly the ultimate destination of the cane-sugar;—

"The intimate connection between cane-sugar and starch in plants has been clearly shown of late years by several chemists. In the case of the tuber of the potato, the dependence of its reserve starch upon the previous existence of cane-sugar in the juices of the plant has been very well shown by Aimé Girard (*Compt. rend.*, 108 (1889), 602). The same has been done for *maize* by H. Lepley (*Compt. rend.*, 94 (1882), 1033), and for *wheat* by Balland (*Compt. rend.*, 106 (1888), 1610)."

"In a series of experiments which we conducted a few years ago upon the barley plant, taken from the fields at various stages of its growth, we were able to satisfy ourselves that cane-sugar forms a large proportion of the sugars existing in the sap of the plant, and that this cane-sugar disappears *pari passu* with the formation and accumulation of starch in the seed."

"It is doubtless in the form of cane-sugar and its products of inversion that the transference of carbo-hydrates in the grasses mainly takes place."

One word may be added in conclusion. Cane-sugar in the sugar-cane, as in the beet, is, as will be seen, the derivative of starch. This substance is the result of the putting together under the constraining action of solar activity of the materials of carbonic acid and water. In the field of nature the process will be most effectively carried on, and the result for the same expenditure in cultivation must be largest where the supply of solar activity is most abundant. All things being equal, the formation of sugar as a product of solar activity ought, in the tropics, to be more easily and cheaply accomplished than in temperate countries.

CLXXXVIII.—TIMBER OF YORUBA-LAND.

The *Kew Bulletin* for October 1890 contained an account of the "Soil and Cultivation in Yoruba-land."

The following correspondence relates to the attempts made by the Governor of Lagos to draw attention to the timber resources of the same country.

A note on Iroko wood (*Chlorophora excelsa*) is appended. This was communicated to Kew by Sir Alfred Moloney, K.C.M.G., January 30, 1884, with some very attractive samples which may be seen in the Kew Museum.

Colonial Office to Royal Gardens, Kew.

Sir, Downing Street, November 10, 1890.

I am directed by Lord Knutsford to transmit to you a copy of a Despatch from the Governor of Lagos, enclosing a circular on the subject of the timber of the Yoruba country, and to ask you to be so good as to advise his Lordship what steps should be taken to make the information known as desired by Sir Alfred Moloney.

I am, &c.

(Signed) John Bramston.

The Director, Royal Gardens,
Kew.

Sir ALFRED MOLONEY to LORD KNUTSFORD.

Government House, Lagos,
October 2, 1890.

MY LORD,

THE sea-board of Yoruba, represented by the Colony of Lagos, is rich in valuable woods, and the network of inland waterways exceptionally favours the development of a profitable export timber trade.

2. I have the honour to transmit a circular I have issued, having for its object the direction of commercial attention to such an enterprise.

3. I shall be obliged if your Lordship will allow such circulation thereof as will promote its object.

I am, &c.
(Signed) ALFRED MOLONEY,
Governor.

The Right Hon. Lord Knutsford, G.C.M.G.,
&c. &c. &c.

[*Circular.*]

Colonial Secretariat, Lagos,
September 24, 1890.

I AM directed by his Excellency the Governor to draw your attention to the advisability of securing for examination and report suitable samples of the various valuable timbers of Yoruba.

There is no doubt that in the interior, and, indeed, at no great distance from the grand network of inland waterways which extends in every direction throughout this Colony, there exist a large number and variety of excellent timber trees, and that this part of West Africa, in common with the Gambia and the Gold Coast, is rich in cabinet woods of good quality and appearance.

All that is needed to make these woods an object of demand in the European market would appear to be a more complete knowledge of their commercial value, and the conditions under which they should be shipped. The celebrated trade of the Gambia in "Mahogany" (*Khaya senegalensis*) and in Rosewood (*Pterocarpus erinaceus*) is rapidly reviving, and from the Gold Coast, celebrated for its Odoom (*Chlorophora excelsa,* synonymous with Iroko, of Yoruba), an encouraging timber export has been established. Under these circumstances it would seem evident that, with proper encouragement and advertising, the timbers of Yoruba would become a profitable addition to the commerce of Lagos.

The appended list of names in the Yoruba language will serve to indicate the different varieties of timber which are at present most valued, locally, for cabinet work, house and canoe building, and otherwise.

His Excellency desires that you should further know that the Government will gladly receive specimen logs of any or all of these native trees, and will undertake to send them to England to be reported on and valued by experts. The British and African and African Steamship Companies have generously offered to co-operate with the Government in its endeavours to secure the establishment of any such enterprise in Yoruba.

The logs should be complete sections of the stems of the trees from which they are taken, should be cut from fully grown timber, and should be from four to six feet in length. The bark should be retained uninjured as far as possible.

All who are interested in the development of the commerce of the country are invited to co-operate with the Government in this matter.

Contributions can be deposited on the embankment near the Harbour Master's Office, and should in each case bear some distinctive letter or mark.

The Colonial Secretary should also be notified of the number of specimen logs supplied by each contributor, of their Yoruba names, their habitat, and distance from navigable water.

The supply of dried specimens of the leaves, flowers, and fruit will enable the Government to have the trees scientifically named.

I have &c.
(Signed) ALVAN MILLSON,
Assistant Colonial Secretary.
pro Acting Colonial Secretary.

APPENDIX.

Names of Yoruba Timbers.

1. Igi egba.
2. Orogbo erin.
3. Etinrin.
4. Opepe.
5. Gedu.
6. Awun.
7. Osun dudu.
8. Palufon.
9. Iroko.
10. Ayon.
11. Abora.
12. Ofun.
13. Osere.
14. Orosun.
15. Abadu.
16. Koriko.
17. Eki.
18. Osun.
19. Iroko oni koko.
20. „ tuntun.
21. Olugbomdu.
22. Akomu.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, November 13, 1890.

I HAVE the honour to acknowledge the receipt of your letter of November 10, transmitting a copy of a Despatch from the Governor of Lagos with copies of a circular on the subject of the timber of the Yoruba country.

2. I have despatched copies to the persons to whom I think it is likely to be commercially interesting, and I propose to reprint it in the forthcoming number of the *Kew Bulletin.*

I am, &c.
(Signed) W. T. THISELTON DYER.

John Bramston, Esq., C.B.

NOTE on Iroko wood by Sir Alfred Moloney, K.C.M.G.

The *Iroko* of the Yoruba country, West Africa, is known on the Gold Coast, behind the Accra coast line, as *Odüm.* To the countries mentioned it is invaluable, as it can withstand for years, not only the weather (for it is often used in exposed parts of buildings, &c.), but also the attacks of the white ant. It is used largely for building purposes, being cut and sawn into beams and plank. Window-frames, shutters, doors, furniture, exterior balconies or verandahs, fences, shingles, &c., are made from it. Most of the Basel Mission Houses on the Gold Coast are, as to woodwork, made of it. I was informed a shingle roof of this material lasted some 20 years.

The *Iroko* or *Odüm* has been and is regarded as a Fetish tree.

Iroko wood is also suitable for furniture, as it is very ornamental when polished, exhibiting a combination of the character of satin and wavy maple woods.

Its botanical identity was determined at Kew. It proves to be the product of *Chlorophora excelsa*, Benth. and Hook. f., and is a near ally of Fustic (*Chlorophora tinctoria*), the well-known dye-wood of the W. India islands and Brazil.

CLXXXIX.—PHYLLOXERA.

The ravages of the Phylloxera upon the vine have been the subject of numerous notices in the preceding volumes of the *Kew Bulletin*: vol. iii., p. 66, Phylloxera in Asia Minor; p. 230, Phylloxera in South Africa; p. 236, Erroneous Report of Phylloxera in Greece; p. 255, Regulations at the Cape; vol. iv., p. 36, Phylloxera in Victoria.

The present position of the struggle between the vine and this ineradicable pest is conveniently summed by Mr. C. V. Riley in the following extract from his annual address to the second annual meeting of the Association of Economic Entomologists, published in *Insect Life*, the periodical Bulletin of the Division of Entomology of the United States Department of Agriculture for January 1891. Mr. C. V. Riley is the Entomologist of the Department, and, it is scarcely necessary to add, the leading authority in Economic Entomology at the present day.

"The Grape Phylloxera has continued to attract the attention, not only of most European Governments, but also of those of Australia and New Zealand. It continues its spread in France, having at last invaded the more valuable champagne districts. The last report of the Superior Phylloxera Commission of that country shows that about 240,000 acres have undergone defensive measures, submersion being employed in 72,000, bisulphide of carbon in 145,000, and sulphocarbonate of potassium in 23,000. The work is practically at an end in such Departments as Hérault, Gard, and Gironde, where the American resistant vines have most effectually been used; while the wine-growers of Algeria, Spain, Italy, Portugal, Hungary, Austria, and Switzerland are all battling against it, and are all more or less aided by their respective governments.

The advent of the insect in New Zealand has been the cause of much writing and of much legislation there, and the government has been quite anxious to get the best and latest information on the subject. There is very little that is available in the way of published experience in this country, as my Missouri reports are now very difficult to obtain. I would repeat here in substance what I have recently written to Sir F. D. Bell, Agent-general at London for New Zealand, because the demand for the information is continuous, and our own people are, to a great extent, unfamiliar with the facts.

During the more than twenty years' struggle in France against the species innumerable remedies have been proposed, most of which have proved to be absolutely valueless. A few measures have been devised, however, which, under proper conditions, give fairly satisfactory results. These consist in (1) methods which avoid the necessity of direct treatment, comprising the use of American stocks and planting in sandy soils; (2) the employment of insecticides (bisulphide of carbon, sulphocarbonate of potassium, and the kerosene emulsion); and (3) submersion.

It was early found in the history of this Phylloxera that most of the cultivated varieties of American grape-vines, as also the wild species, resisted, or were little subject to, the attacks of the root form (*radicicola*) of the Phylloxera, although the leaf gall form (*gallicola*), which in point of fact does little if any permanent damage, occurs in greater numbers on many of our wild and cultivated sorts than on the European grape-vines, which are all derived from the single species, *Vitis vinifera*, and which are so exceedingly subject to the attacks of the root form. This fact was first noticed in France by M. Laliman, of Bordeaux, and later by Gaston Bazille, of Montpellier, and was independently proved on a more extended scale by my earlier investigations in the United States. The use of American stocks upon which to cultivate the susceptible European varieties has resulted in an enormous trade in certain American seeds and cuttings, and now supersedes all other methods against the insect.

It was my privilege and pleasure to spend a week in August 1889 among the world-renowned Médoc and Sauterne vineyards of the Bordeaux district in France. Here, by virtue of the rich alluvial soil and the ease with which the chief vineyards can be submerged, the Phylloxera has made slower headway, and the opposition to the use of American resistant stocks has been greatest. Yet they have finally vanquished prejudice and are, either from necessity or choice, rapidly coming into general use. When I say choice, I mean that even where the French vines yet do well and the Phylloxera is kept in subjection by other means, it is found that great vigour of growth and increase in healthfulness and yield of fruit result at once from the use of American stocks.

Without going into a lengthy discussion of the subject of wild American species, those of practical importance to the grape-grower are the following: *Vitis æstivalis*, *V. riparia*, and *V. labrusca*.

The varieties derived from *V. æstivalis* are of value for their fruit as well as for their resistant qualities, and, being easily propagated from cuttings, they are very often used in France as stocks. The most important varieties are Jacquez, Herbemont, Black July, and Cunningham.

The varieties of *Vitis riparia*, both wild and cultivated, are, on account of their special fitness, almost exclusively employed in France as resistant stocks, for which they easily take first rank. The varieties used are, first, the wild forms; and, second, the cultivated varieties Solonis, Clinton, and Taylor. Of the cultivated varieties, the Clinton was one of the first vines tried for this purpose and has been extensively used with fair satisfaction. The Solonis now ranks above it, but is valueless for any other purpose on account of the acidity of its grapes. In California, the Lenoir, Herbemont, and Elvira have been used, but late experience shows that the wild Riparia is most satisfactory there, as it is in France.

The different varieties of *Vitis labrusca* are less resistant to the Phylloxera than those above mentioned. Certain varieties have, however, been grown successfully in France, and of these the Concord has given much the best results; but others, Isabella and Catawba for example, succumb there to the root-louse, as indeed they do in many sections of this country.

Of the many valuable hybrids obtained from the American species of *Vitis* which are serviceable as stocks, the more important are the Elvira, Noah, and Viala. The last named, perhaps of all the resistant varieties, gives the greatest per-centage of successful grafts, and is admirably adapted for grafting on cuttings.

Early in the study of the subject it was found that the nature of the soil has a very marked influence on the success of the different stocks. The subject has now been quite fully investigated in France, and the latest researches are formulated by the experimental school at Montpellier in the statement quoted below, which will be of interest as giving the various classes of soils, together with the American vines best adapted to each.

(1.) New, deep, fertile soils: *Riparia* (tomentous and glabrous), *Jacquez*, *Solonis*, *Viala*, *Taylor*, and *Cunningham*.

(2.) Deep soils, somewhat strong, not wet: *Jacquez*, *Riparia*, *Solonis*, *Cunningham*, *Viala*, *Taylor*.

(3.) Deep soils of medium consistency, new and not dry in summer: *Riparia*, *Jacquez*, *Solonis*, *Viala*, *Taylor*, *Black July*.

(4.) Light pebbly soils, deep, well drained, and not too dry in summer: *Jacquez*, *Riparia* (wild), *Taylor*, *Rupestris*.

(5.) Calcareous soils, with subsoil shallow or granitic: *Solonis*, *Rupestris*.

(6.) Argillaceous soils, white or grey: *Cunningham*.

(7.) Argillaceous soils, deep and very wet: *V. cinerea*.

(8.) Deep, sandy, fertile soils: *Riparia* (wild), *Solonis*, *Jacquez*, *Cunningham*, *Black July*, *Rupestris*.

(9.) Light pebbly soils, dry and barren: *Rupestris*, *York*, *Madeira*, *Riparia* (wild).

(10.) Deep soils, with a tufa base and salt lands: *Solonis*.

(11.) Soils formed of débris of tufa, but sufficiently deep: *Taylor*.

(12.) Ferruginous soils, containing red pebbles of silica, deep and somewhat strong, well drained, but fresh in summer. All the varieties indicated, and in addition: *Herbemont*, *Clinton*, *Cynthiana*, *Marion*, *Concord*, *Herman*."

CXC.—BOTANICAL STATION AT LAGOS.

Particulars respecting the establishment and progress of this the first Botanical Station on the West Coast of Africa have already been given in the *Kew Bulletin* (June 1888, p. 149; March 1889, p. 69; and July 1890, p. 162).

The following correspondence gives the most recent accounts of its progress.

The prospects of Annatto cultivation at this station are discussed in the *Kew Bulletin* for July 1890.

At the conclusion of last year the late Curator, Mr. James McNair, resigned his appointment for the purpose of returning to the West Indies. He has been succeeded by Mr. Henry Millen, of the Royal Gardens, Kew.

The Colony is under great obligations to Mr. McNair for the faithful way in which he has carried out the work entrusted to him of organising and stocking the new station, which has now, it is hoped, passed into the stage of a permanently useful institution.

Colonial Office to Royal Gardens, Kew.

Sir, Downing Street, January 30, 1891.

I am directed by the Secretary of State for the Colonies to transmit to you, for your information, the accompanying paper relating to the Botanic station at Lagos.

I am, &c.
(Signed) **Robert G. W. Herbert.**

The Director, Royal Gardens,
Kew.

Sir A. Moloney to Lord Knutsford.

Government House, Lagos,
December 31, 1890.

My Lord,

In continuation of my Despatch, No. 386, of the 27th ultimo, I have the honour to transmit the twelfth report on the Botanic Station of the Colony of Lagos, for the quarter ended the 30th of September 1890.

2. 3130 plants and 32 ounces of Annatto seed have been sold in addition to the yield of the vegetable garden. The plants consisted chiefly of 1,480 coffee, 800 annatto, 49 cacao, and 300 coco-nut seedlings.

3. The amount realised by the sale of the products of this department was 12*l.* 8*s.* 11*d.*

4. Many contributions were made to the station during the quarter, acknowledgments of which are detailed in the report.

5. The rainfall has considerably exceeded without harm that for the corresponding periods of 1887, 1888, and 1889.

6. The graceful and useful beef-wood tree, *Casuarina muricata*, seeds of which were kindly supplied in March quarter 1889 by the Royal Gardens, Kew, has been found to answer here admirably; it thrives luxuriantly even along the sand beaches in close proximity to the sea.

7. A small nursery of fibre-yielding plants of commercial importance has been established in the Western District.

8. There has continued the usual activity in the direction of the extension of the cocoa-nut industry in the form of adding seeds to the local nurseries and of planting out seedlings in permanent places.

9. I regret that some damage by fire, which is to be attributed to accident, has occurred to the Government cocoa-nut plantations in the Western District, the effect of which cannot yet be accurately gauged. The copious rain that has since fallen it is expected will revive many.

I am, &c.
(Signed) **Alfred Moloney,**
Governor.

The Right Hon. Lord Knutsford, G.C.M.G.,
&c. &c. &c.

CXCI.—MEALY BUG AT ALEXANDRIA.

In the *Kew Bulletin* for May 1890 an account is given of "a Mealy Bug, very destructive to cultivated plants," which has recently made its appearance at Alexandria. This was described by Mr. J. W. Douglas as *Crossotosoma ægyptiacum.*

Mr. Riley, the United States entomologist, makes the following remarks upon the subject in the January number of *Insect Life*, p. 184:—

"A study of Mr. Douglas's description and figures has convinced me that this insect is an *Icerya*, and that its spread is greatly to be feared judging from our experience with *I. Purchasi*. Moreover, three additional species of this genus have been brought to my notice during the year: one occurring in Mexico on grapevines; another in Key West, Florida, upon roses and other garden plants; and the third in the island of Montserrat, West Indies, upon the cocoa palm, the banana, and a species of *Chrysophyllum*."

A full account of *Icerya Purchasi*, Maskell, the Fluted Scale-insect, was published in the *Kew Bulletin* for August 1889.

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 51.] MARCH. [1891.

CXCII.—COTTON IN WEST AFRICA.

In the *Kew Bulletin* for June 1890 an account is given of the attempt which has been made to improve the produce of cotton in West Africa by introducing the best forms of Egyptian cotton. "This " cotton has many advantages in length, strength, and fineness of fibre " over that grown in America, and commands a much higher price; " at present its production is limited to the Nile valley, where there " is no room for extension to meet the increasing demand, and where " the crop is at times almost ruined by a low Nile."

The present correspondence relates to the experimental cultivation of Egyptian cotton on the Gold Coast.

Curator, Botanical Station, Aburi, to Royal Gardens, Kew

[*Extract.*]

Botanical Station, Aburi,
Gold Coast, West Africa,
November 11, 1890.

Sir,

I am directed by his Excellency to inform you that he is sending to Kew a sample of the Egyptian cotton grown at Aburi. I beg to state that I planted an acre of this cotton. It has grown remarkably well, and is yielding a good crop. I have already gathered a large quantity, and there is still a quantity not yet ready for gathering.

I am, &c.
(Signed) W. Crowther.

The Assistant Director,
Royal Gardens, Kew.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE and SPOTTISWOODE, East Harding Street, Fleet Street, E.C., and
32, Abingdon Street, Westminster, S.W.; or
JOHN MENZIES & Co., 12, Hanover Street, Edinburgh, and
88 and 90, West Nile Street, Glasgow; or
HODGES, FIGGIS, & Co., 104, Grafton Street, Dublin.

1891.

Price Twopence.

ROYAL GARDENS, KEW, to GOVERNOR, GOLD COAST COLONY.

SIR, Royal Gardens, Kew, December 23, 1890.

I HAVE the honour to acknowledge the receipt of a sample of Egyptian cotton which I learn from a letter from Mr. Crowther, Curator of the Botanical Station at Aburi, was grown by him there. This was no doubt raised from seed obtained by Kew early in the present year from the British Commissioner of the Egyptian State Domains.

2. This sample was submitted to the Manchester Chamber of Commerce, and I have now the pleasure of forwarding you a copy of their report.

3. I find that a sample of cotton from Elmina was received at this establishment in 1882 from the Colonial Office. It was reported upon as having for its chief fault "the large proportion of short inferior "wool."

4. I trust that the station will possess in the new strain of Egyptian cotton a staple free from this defect, and will be able to promote its growth throughout the Colony.

I am, &c.
(Signed) W. T. THISELTON DYER.

His Excellency
Sir W. Brandford Griffith, K.C.M.G.,
Governor, &c., Gold Coast.

CHAMBER OF COMMERCE, MANCHESTER, to ROYAL GARDENS, KEW.

Chamber of Commerce, Manchester,
DEAR SIR, December 11, 1890.

I THANK you for your letter of the 10th instant, and for the sample of cotton named therein, which has come to hand. This will be submitted to the Board of Directors in accordance with your request, and I hope to forward a report upon them in the course of a few days.

Yours, &c.
(Signed) ELIJAH HELM,
Secretary.

CHAMBER OF COMMERCE, MANCHESTER, to ROYAL GARDENS, KEW.

Chamber of Commerce, Manchester,
DEAR SIR, December 20, 1890.

I HAVE now the pleasure to report to you upon the sample of Egyptian cotton grown at Aburi, on the Gold Coast, forwarded to me on the 10th instant.

This cotton is worth to-day about 5½*d.* per pound in Liverpool or Manchester, and at that price it would find a ready sale. The growth of it should be encouraged. Can you tell me whether or not the Gold Coast Egyptian cotton represented by your sample is imported in the ginned or unginned state? I am informed by a gentleman who used to bring this description to England that he could not get it ginned in Africa, because the natives were either not sufficiently intelligent or too superstitious to use a ginning machine, although this is of the simplest description, resembling very closely an ordinary hay-cutter. It is to be feared that if this difficulty still exists it will constitute a formidable, if not an insurmountable, obstacle to the export of this cotton from the Gold Coast.

Yours, &c.
(Signed) ELIJAH HELM,
Secretary.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, December 16, 1890.

I AM directed by Lord Knutsford to transmit to you some specimens of Egyptian cotton, cleaned of seeds and uncleaned, grown on the Castle Farm, Christiansborg, Accra, which have been sent home by the Governor of the Gold Coast Colony. He states that the seed was planted at the end of June, and the cotton picked between the 5th and 14th November.

Lord Knutsford would be much obliged if you could furnish him with a report on the commercial value of these specimens.

I am, &c.
(Signed) R. H. MEADE.

The Director,
Royal Gardens, Kew.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, February 9, 1891.

I HAVE the honour to acknowledge the receipt of your letter of December 16, transmitting a report on a sample of Egyptian cotton, grown on the Castle Farm Christiansborg, Accra, and sent home by the Governor of the Gold Coast Colony.

2. In accordance with Lord Knutsford's wish the enclosed report upon the sample has been obtained from the Manchester Chamber of Commerce, which has very obligingly assisted this establishment on this and other occasions.

3. From the correspondence published in the *Kew Bulletin* for June 1890 you will observe that the production of this type of cotton if successful in West Africa may be made the basis of a very profitable industry. You will, therefore, no doubt also observe with satisfaction that the present sample is reported upon in very favourable terms. The estimated value is the highest which has been put upon any sample of cotton yet received from West Africa.

I am, &c.
(Signed) W. T. THISELTON DYER.

The Hon. R. H. Meade, C.B.

CHAMBER OF COMMERCE, MANCHESTER, to ROYAL GARDENS, KEW.

Chamber of Commerce, Manchester,
February 4, 1891.

DEAR SIR,

I HAVE pleasure in reporting to you upon the sample of Egyptian cotton, ginned and unginned, grown at Castle Farm, Christiansborg, Accra, forwarded by you on the 19th December. It has been submitted to the judgment of experts, members of this Chamber, and is described as good, clean, and very desirable cotton, worth to-day about 6⅝*d.* per pound in Liverpool. Can you inform me whether the sample was ginned in Africa or in this country?

Yours, &c.
(Signed) ELIZAH HELM,
Secretary.

CXCIII.—LIST OF ORCHIDS FLOWERED AT KEW IN 1890.

Since 1887 a record has been kept of the Orchids which have flowered each year at Kew. The list for last year, 1890, does not materially differ from those of previous years, but it is published as affording data as to the time and duration of the flowering period of Orchids cultivated in England. It enumerates 766 species and varieties.

The Kew collection of Orchids differs in character as well as in extent from all other collections, except those of similar establishments. No attempt is made to give prominence to the most showy flowered by the cultivation of a large number of examples. On the other hand, every effort is made to obtain and cultivate even small and unattractive kinds of scientific interest, such as the ordinary collector would consider beneath his notice. In the limited space available for Orchids as comprehensive a collection of species as possible is aimed at. Consequently, whilst there is never a great display of Orchid flowers at Kew, at no time of the year is the collection wanting in flower interest. Thus, whilst the highest number of species flowered in any one month was 125 in May, the lowest was 85 in January. The average for each month was a fraction over one hundred.

A few words on the growth of the Kew collection of Orchids may be interesting. In 1811 the number of species in cultivation at Kew was only 37. It was not until some thirty years after this that efforts were made to obtain a representative collection of these plants, which at that time had begun to attract the attention of horticulturists generally. Soon after Sir William Hooker's appointment as Director in 1841, he made arrangements with the Messrs. Loddiges, of Hackney, at that time the most celebrated of European nurserymen, to supply Kew with 200 species of Orchids for 50*l*.

The collection of Orchids formed by the Rev. J. Clowes, of Broughton Hall, near Manchester, was bequeathed by him to Kew, whither it was transferred in 1846. Liberal gifts of Orchids were made about the same time by the Duke of Bedford and others. Exchanges were also made with growers of Orchids, and collectors were instructed to send home living plants of this family, until by the year 1850 the collection at Kew had increased to 830 species. From some cause or other the number fell again to 638 species in 1864, but by 1880 it had again risen to about 950 species. At the present time (Jan. 1891) there are in cultivation at Kew 1,342 species, comprised in 158 genera. These figures do not include 174 varieties and over 100 undetermined plants. The collection is kept up by means of exchange and a small outlay, about 20*l*. annually, for plants which can only be obtained by purchase.

Some of the most noteworthy amongst the genera represented in the following tables are:—*Dendrobium*, of which 69 species flowered last year; *Masdevallia*, 53 species; *Cœlogyne*, 31 species; *Oncidium*, 40 species; *Odontoglossum*, 28 species; *Cattleya*, 24 species; and *Cypripedium*, 38 species (exclusive of hybrids). Amongst smaller or less known genera may be noted:—*Angræcum*, 17 species; *Bulbophyllum*, 19 species; *Catasetum*, 9 species; *Pleurothallis*, 20 species; and *Phalænopsis*, 12 species.

The flowering period of many Orchids extends over a considerable portion of the year, some, such as, for instance—*Cypripedium longifolium*, *Masdevallia pulvinaris*, and *Odontoglossum crispum*, which were in flower all through the year.

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Acampe :													
dentata	India											×	×
multiflora	China								×				
Acineta :													
chrysantha	New Granada							×					
sulcata	South America							×					
Acanthephippium :													
bicolor	Ceylon						×						
Ada :													
aurantiaca	New Granada	×	×										
Lehmannii	,,								×				
Aëonia :													
polystachya	Peru	×	×										
Aëranthus :													
curnowianus	Madagascar							×					
Arachnites	,,											×	
grandiflorus	,,							×					
Leonis	Comoro Islands							×					
Aërides :													
affine var. roseum	East Indies					×							
crassifolium	Burma					×							
Emerici	South Andamans				×								
expansum var. Leonæ	India					×							
houlletianum	Cochin China					×							
leeanum	Philippines					×							
Lawrenciæ	East Indies								×				
Lobbii	Moulmein					×							
odoratum	Khasia Mountains					×							
savageanum	Borneo					×							
Warneri	Bombay					×							
Angræcum :													
ashantense	E. Tropical Africa								×				
arcuatum. aff.	Grahamstown								×				
bilobum var. Kirkii	Gold Coast										×	×	
distichum	Sierra Leone												×
eburneum	Madagascar	×	×										×
— var. virens	,,	×	×										×
fragrans	Mauritius	×	×										
glomeratum	Sierra Leone										×	×	

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Angræcum—*cont.*													
Hildebrandtii	Comoro Islands										×	×	×
henriquesianum	I. of St. Thomas										×	×	
ichneumoneum	Madagascar									×	×		
odoratissimum	Tropical Africa										×	×	×
pellucidum	Sierra Leone										×	×	
pertusum	Tropical Africa										×	×	
sacciferum	South Africa								×				
sanderianum	Comoro Islands			×									
scottianum	,,					×	×	×					
tridactylites	Sierra Leone								×				
Anguloa:													
Clowesii	Colombia					×	×						
Ruckerii	,,					×	×						
— var. sanguinea	,,					×	×						
Ansellia:													
africana	Tropical Africa	×										×	×
— var. gigantea	,,			×									
Amblostoma:													
tridactyla	Brazil	×	×										
Appendicula:													
Luisii	Penang										×		
Arachnanthe:													
Cathcartii	Sikkim		×	×									
Clarkei	East Himalayas								×	×			
Arpophyllum:													
spicatum	Mexico				×								
Arundina:													
bambusæfolia	North India											×	
Bifrenaria:													
vitellina	Brazil						×	×					
Bletia:													
hyacinthina	China and Japan			×	×								
— var. purpurea	,, ,,			×	×								
verecunda	Central America									×	×	×	×
Brassavola:													
fragrans	West Indies									×	×	×	
Perrinii	Brazil						×						
Brassia:													
ocanensis	New Granada	×											

——	——	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Brassia—*cont.*													
verrucosa	Guatemala					×	×						
Broughtonia:													
lilacina	San Domingo					×	×						
sanguinea	Jamaica						×	×	×	×	×		
Bulbophyllum:													
cæspitosum	Madagascar						×						
careyanum	East Indies									×			
crassipes	India									×	×		
cupreum	Caracas									×			
Drallei	W. Trop. Africa										×		
fuscum	Sierra Leone			×									
gibbosum	Java										×		
hirtum	Himalayas										×	×	×
imbricatum	Khasya Hills										×	×	×
Lobbii	Java						×						
macranthum	"					×							
meridense, aff.	South America									×			
neilgherrense	Neilgherries											×	×
odoratissimum	Borneo			×									
Pêchéi	Moulmein											×	×
rufinum	Burma										×		
striatum	Khasya Hills											×	
umbellatum	North India								×				
Caladenia:													
clavigera	Australia				×								
Calanthe:													
Dominii	Garden Hybrid						×	×	×				
pleiochroma	Japan							×	×				
rosea	Moulmein	×											
Regnieri	Cochin China		×										
Turneri	Moulmein	×											
Veitchii	Garden Hybrid	×									×	×	×
— var. lactea	" "												×
— var. splendens	" "											×	×
veratrifolia	East Indies									×	×	×	×
vestita	Burma									×	×	×	×
— var. aurantiaca.	"										×	×	×
— var. oculata	"										×	×	×

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Calanthe—*cont.*													
vestita var. rubro oculata.	Burma										×	×	×
— var. Sedeni												×	×
striata	Japan			×	×								
Calypso:													
borealis	North America					×							
Catasetum:													
barbatum	Demerara												×
darwinianum	British Guiana								×	×	×		
discolor	Brazil									×	×	×	×
garnettianum	"			×	×							×	×
Gnomus	"			×								×	
longifolium	Demerara											×	
macrocarpum	Tropical America									×	×	×	×
Naso	Caracas							×					
russellianum	Guatemala								×	×			
Cattleya:													
bowringiana	Brit. Honduras									×	×		
citrina	Mexico			×	×								
dowiana	Costa Rica								×	×			
— var. aurea	Colombia								×	×			
Eldorado	Central America									×	×		
Forbesii	Brazil						×				×		
gaskelliana	"						×	×	×				
Gigas	Tropical America						×						
guttata	Brazil												
— var. Prinzii	"			×									
intermedia	"				×								
lawrenceana	British Guiana			×	×								
lindleyana	Bahia	×											
Loddigesii	Brazil						×						
— var. harrisoniana violacea.	"									×			
luteola	"	×											×
maxima	Tropical America												
— var. peruviana	" "										×	×	
Mendellii	Colombia				×	×	×						
Mossiæ	Venezuela				×	×							
percivaliana	Brazil	×	×										
porphyrophlebia	Garden Hybrid								×				

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Cattleya—*cont.*													
Schroderæ	Colombia				×								
Skinneri	Guatemala				×								
superba	British Guiana							×					
Trianæ	Corderillas of	×	×										
— var. delicata	Quindiu	×											
walkeriana	Brazil	×											
Warneri	,,					×	×						
Chysis:													
bractescens	Mexico			×						×			
Cirrhæa:													
saccata	Brazil						×						
warreana	,,			×									
Cirrhopetalum:													
fimbriatum	East Indies		×										
Macræi	Ceylon											×	
Medusæ	Singapore											×	
picturatum	Borneo		×							×			
Wallichii	Nepal										×	×	×
Wightii	Ceylon		×										
Cleisostoma:													
wendlandiana	Tropical Asia				×								
Cochlioda:													
rosea	Peru	×	×										
Cœlia:													
baueriana	West Indies				×								
macrostachya	Mexico									×	×		
Cœlogyne:													
conferta	India		×										
corrugata	,,							×	×				
corymbosa	North India				×								
cristata	,, ,,	×	×	×									
— var. lemoniana	,, ,,		×	×									
elata	Sikkim		×										
elegans	,,			×									
fimbriata	India									×			
flaccida	Nepal		×										
flavida	Sikkim						×						
fuliginosa	India										×	×	
fuscescens	North India											×	×

——	——	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Cœlogyne—*cont.*													
gardneriana	East Indies											×	×
humilis	North Indian Alps		×	×									
lagenaria	Khasia Mountains								×	×			
lentiginosa	Moulmein	×											×
longipes	Khasia Hills						×						
maculata	India										×	×	
massangeana	Assam								×	×			
mayeriana	Tropical Asia							×					
nervosa	Neilgherries							×	×				
ocellata	North India									×	×		
ochracea	„ „					×							
pandurata	Borneo			×	×								
Parishii	Moulmein					×							
rhodeana	Moluccas											×	×
schilleriana	Moulmein					×							
sparsa	Philippines				×								
speciosa	Java						×	×	×	×			
tomentosa	Tropical Asia			×	×								
uniflora	North India				×								
wallichiana	North India										×	×	
Collabium:													
nebulosum	Java	×											
Cottonia:													
macrostachya	India				×	×	×	×	×	×			
Cryptochilus:													
sanguineus	Himalayas					×							
Cryptophoranthus:													
maculatus	Brazil											×	×
Cycnoches:													
chlorochilum	Demerara								×				
ventricosum	Guatemala										×		
Cymbidium:													
aloifolium	East Indies			×	×								
devonianum	India			×	×								
eburneum	North India			×	×								
giganteum	Nepal										×	×	
lowianum	Burma				×	×							×
pendulum	East Indies						×	×	×				
sinense	China											×	×

——	——	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Cyperorchis:													
elegans	**India**										×	×	×
Cypripedium:													
Argus	**Philippines**		×	×									
barbatum	**Tropical Asia**				×	×							
— var. biflorum	**Mount Ophir**										×	×	×
bellatulum	**Tropical Asia**		×	×							×	×	×
Boxalli	„ „	×	×										×
bullenianum	**Borneo**												×
— var. anopthalmum.	„					×							
callosum	**Cochin China**										×	×	×
calurum	**Garden Hybrid**							×	×	×	×	×	×
cardinale	„ „						×	×	×	×	×	×	×
caudatum	**Peru**				×	×							
ciliolare	**Malay Arch.**				×	×							
conchiferum	**Garden Hybrid**	×	×	×	×	×	×	×	×	×	×	×	×
concolor	**Moulmein**	×	×										
— var. Regnieri	**Cambodia**					×	×						
Curtisii	**Philippines**						×	×	×				
Dauthieri	**Garden Hybrid**											×	×
dayanum	**Borneo**					×	×						
dominianum	**Garden Hybrid**	×	×										×
Godefroyæ	**Siam**						×	×					
harrisianum	**Garden Hybrid**								×	×			
hirsutissimum	**Java**			×	×								
Hookeræ	**Borneo**					×	×						
insigne	**Nepal**	×									×	×	×
— var. Maulei	**India**	×									×	×	×
Io	**Garden Hybrid**								×	×	×		
javanicum	**Java**										×	×	
klotzschianum	**British Guiana**										×	×	×
lawrencianum	**Borneo**				×	×	×						
leeanum	**Garden Hybrid**	×											×
lindleyanum	**New Granada**												×
longifolium	**Central America**	×	×	×	×	×	×	×	×	×	×	×	×
Lindeni	**Colombia**					×	×						
Meirax	**Garden Hybrid**			×	×								
niveum	**Malay Arch.**					×	×						
Parishii	**Burma**					×	×	×					

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Cypripedium—*cont.*													
parviflorum	North America					×							
Pearcei	Peru					×							
politum	Garden Hybrid	×											
porphyreum	„ „	×	×	×	×	×	×	×	×	×			
pubescens	North America					×							
purpuratum	Khasia Mountains									×	×		
Roezlii	New Granada	×	×	×	×	×	×	×	×	×	×	×	×
sanderianum	Malay Arch.								×	×			
Schlimii	Colombia	×									×	×	×
Sedeni	Garden Hybrid	×	×	×	×	×	×	×	×	×	×	×	×
— var. candidulum.	„ „											×	×
selligerum	„ „			×	×								
spectabile	North America					×							
spicerianum	East Indies										×	×	
Stonei	Borneo				×	×							
venustum	East Indies											×	×
— var. spectabile	Sylhet											×	×
villosum	Moulmein	×	×										
Dendrobium :													
æmulum	New South Wales		×	×									
aggregatum	India			×	×								
Ainsworthii	Garden Hybrid	×	×							×			
albosanguineum	Moulmein					×							
anceps ?	Pegu										×		
aureum	East Indies										×	×	×
bracteosum	New Guinea								×	×	×		
bigibbum	New Zealand										×	×	×
capillipes	Moulmein			×									
chloropterum	New Guinea				×								
chrysanthum	Nepal										×	×	×
chrysotoxum	East Indies		×										
ciliatum	Moulmein												
— var. breve	„							×					
crassinode	Siam	×	×										
— var. barberianum.	Moulmein		×										
crepidatum	Assam			×									
cretaceum	„		×										
— var. roseum	„		×										

——	——	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Dendrobium—*cont.*													
crumenatum	Malay Arch.			×									
crystallinum	Burma			×									
cumulatum	Moulmein											×	
dalhousieanum	India			×									
densiflorum	East Indies			×									
devonianum	Khasia Mountains			×									
dixanthum	Moulmein					×							
eburneum	„	×											
fimbriatum	India			×									
— var. oculatum	Khasia		×										
findlayanum	Burma		×			×							
fuscatum	Himalayas						×						
heyneanum	Deccan								×				
hircoglossum	Malacca								×				
jamesianum	Burma					×							
japonicum	China and Japan				×								
Jenkinsii	India			×									
kingianum	Australia			×									
— var. pallidum	„		×										
linawianum	China and Japan		×										
linguaeforme aff.	N.E. Australia			×						×			
lituiflorum	East Indies			×									
— var. Freemanni.	„			×									
Loddigesii	South China				×								
luteolum	Moulmein		×										
Mac Carthiæ	Ceylon				×							×	
macrostachyum	„									×			
macrophyllum	Java					×							
mesochlorum	India				×								
moschatum	East Indies				×								
mutabile	India					×							
nobile	East Indies	×	×	×									
— var. nobilius	-		×	×									
— var. sanderianum.	-		×	×									
nodatum	Moulmein				×								
parcum	Burma		×										
Parishii	Moulmein				×								
Phalænopsis	Timor									×			

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Dendrobium—*cont.*													
Pierardi	India		×	×									
plicatile	Manilla								×				
primulinum	Moulmein			×									
purpureum	Moluccas												
— var. Moseleyi							×						
rhodostoma	Garden Hybrid							×					
rhodocentrum	India					×							
Ruckeri	Philippines		×										
sanguinolentum	Ceylon												
secundum	Malayan Islands							×					
speciosum	Australia		×										
— var. Hillii	,,		×										
suavissimum	Burma					×							
superbiens	North Australia	×		×									
superbum	East Indies			×									
thyrsiflorum	Moulmein			×									
transparens	Himalayas				×								
Williamsonii	Assam			×									
wardianum	,,	×											
undulatum	North Australia			×									×
Diacrium:													
bicornutum	West Indies				×								
Disa:													
grandiflora	South Africa								×				
racemosa	,, ,,					×							
tripetaloides	,, ,,					×							
Earina:													
mucronata	New Zealand				×								
Epidendrum:													
brachyglossum	Peru											×	
Brassavolæ	Colombia						×						
ciliare	Tropical America							×					
cochleatum	,, ,,											×	×
cooperianum	Brazil											×	×
difforme	West Indies	×											
discolor	Rio Janeiro				×								
elongatum	West Indies			×									
equitans	Mexico						×						
fragrans	Tropical America	×											

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Epidendrum—*cont.*													
— var. megalanthum.	Tropical America				×								
ionosmum	Demerara					×							
inversum	Brazil								×				
ellipticum	„										×		
ledifolium	Mexico						×						
nemorale	„						×						
odoratissimum	Brazil		×										
patens	Jamaica							×					
polybulbon	West Indies	×											
purum	Colombia									×			
radiatum	Mexico						×						
ramosum	West Indies										×		
Schomburgkii	Demerara							×					
selligerum	Mexico												
— var. purpureum						×							
variegatum	Tropical America					×							
venosum	Mexico					×							
verrucosum	West Indies	×											
virgatum	Mexico						×						
virens	Tropical America						×						
vitellinum	Guatemala												
— var. majus	Mexico						×						
Wallisii	New Granada	×	×	×									
Eria:													
convallarioides	Nepal						×						
Corneri	Formosa								×				
excavata	Nepal			×									
flava	Himalaya	×	×										
lindleyana	Ceylon		×										
obesa	Burma							×					
paniculata	India				×								
pubescens	Neilgherries									×			
velutina	Malacca								×				
vittata	India		×										
Eulophia:													
lurida	Sierra Leone				×								
Galeandra:													
barbata	West Indies		×										×
Baueri	Guiana					×							

——	——	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Gomeza:													
crispa	Brazil			×									
planifolia	Rio Janeiro								×				
Gongora:													
bufonia	Brazil												
— var. leucochila	„			×									
galeata	Mexico								×				
Goodyera:													
discolor	East Indies		×										
japonica	Japan	×											
procera	Tropical Asia				×								
Grobya:													
Amherstiæ	Brazil									×			
galeata	„												×
Habenaria:													
militaris	Cochin China									×			
Hexadesmia:													
crurigera	Central America							×					
fasciculata	Mexico					×							
fusiformis	West Indies					×							
Houlletia:													
lowiana	Colombia								×				
Lælia:													
anceps	Mexico	×											×
autumnalis	„												
— var. atro-rubens	„										×	×	×
cinnabarina	Brazil												
— var. harpophylla.	„		×										
crispa	„							×					
dormanniana	Rio Janeiro										×		
elegans	Brazil								×				
majalis	Mexico						×						
monophylla	Jamaica							×					
lobata	South Brazil				×								
pumila	Brazil												
— var. dayana	„									×			
xanthina	„							×					
Liparis:													
Bowkeri	South-east Africa									×			

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Liparis—*cont.*													
cuneilabris	Australia									×			
disticha	Trop. Asia								×				
longipes	India												
— var. spathulata.	,,										×		
Prainii	Assam								×				
Lissochilus:													
Krebsii	Natal					×							
Lockhartia:													
elegans	Trinidad		×										
Luisia:													
primulina	Tenasserim						×						
Lycaste:													
aromatica	Mexico					×							
Barringtoniæ	New Granada		×										
cochleata	Tropical America					×							
Deppei	Peru					×							
dowiana	,,				×								
fulvescens	New Granada			×									
gigantea	,, ,,											×	×
(Paphinia) grandis.	,, ,,			×									
leucantha	Central America						×						
(Paphinia) lindeniana.	,, ,,								×				
plana	Bolivia		×										
schilleriana	Central America			×									
Skinneri	Guatemala	×	×	×									
xytriophora	Ecuador									×			
Masdevallia:													
acrochordonia	Ecuador									×	×	×	
amabilis	Colombia												
— var. lineata striata.	- -					×							
anchorifera	New Granada					×							
Benedicti	Colombia			×									
bella	,,							×					
campyloglossa	New Granada						×						
canaliculata	- -							×					
capsularis	Colombia					×		×					
Carderi	New Granada					×							

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Masdevallia—*cont.*													
Chelsoni	Garden Hybrid				×								
Chestertoni	New Granada							×					
Chimæra	Colombia					×							
— var. Gorgona	- -							×					
demissa	Costa Rica							×					
erythrochæte	Colombia							×					
Estradæ	„						×						
floribunda	Mexico									×			
gemmata	New Granada									×			
gibberosa	Colombia		×										
guttulata	South America			×									
harryana	Colombia					×							
hieroglyphica	New Granada						×						
gracilenta	Costa Rica							×					
ignea	Colombia			×									
ionocharis	„								×				
Lindeni	New Granada				×								
— var. Winnii	- -					×							
macrura	New Granada	×											
mooreana	„ „	×											
melanopus	Peru		×										
muscosa	New Granada						×						
maculata	Colombia						×						
Nycterina	„							×					
octhodes	Colombia	×	×	×	×	×	×	×	×	×	×	×	×
pachyura	West S. America	×											
platyrhachis	Costa Rica	×						×					
platyglossa	- -						×						
polysticta	North Peru		×										
porcelliceps	New Granada						×						
punctata	„ „				×								
pulvinaris	„ „	×	×	×	×	×	×	×	×	×	×	×	×
radiosa	„ „				×								
reichenbachiana	Costa Rica						×						
Roezlii	New Granada							×					
senilis	„ „				×								
simula	„ „					×							
Shuttleworthii	Colombia	×											
— var. xanthocorys.	„			×									

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Masdevallea—*cont.*													
tovarensis	New Granada	×											×
triangularis	Colombia	×											
triaristella	Costa Rica					×							
trichæte	New Granada						×						
tridactylis	„ „					×							
triglochin	Ecuador						×						
Wallisii	New Granada								×				
xanthina	Colombia					×							
Maxillaria:													
aciantha	Costa Rica					×	×	×					
acutipetala	Central America				×								
aureo-fulva	Brazil							×					
crassifolia	Colombia						×						
cucullata	Central America									×	×	×	×
callichroma	Caracas						×						
densa	Mexico		×										
grandiflora	Peru									×	×	×	×
lepidota	Colombia							×					
luteo-alba	„			×									
meleagris	Mexico									×	×	×	×
nigrescens	New Granada									×	×		
picta	„ „											×	×
punctata	Brazil												×
puncto-striata	Guatemala									×	×		
porphyrostele	South Brazil		×										
rufescens	Trinidad			×									
scabrilinguis	Colombia					×							
setigera	New Granada											×	
stachyobiorum	Central America											×	
tenuifolia	Mexico					×							
variabilis	„	×											
— var. lutea	„	×											
— var. media	„	×											
venusta	New Granada						×	×	×				
Wagneri	Caracas											×	
Megaclinium sp.	Lagos	×											
Microstylis:													
Rheedi	India, Java, &c.				×								
Wallichi	Moulmein					×							

———	— - —	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Miltonia:													
candida	Brazil									×			
Clowesii	„								×	×	×		
cuneata	„			×						×			
Phalænopsis	Colombia						×						
spectabilis	Brazil					×	×						
— var. moreliana	„							×	×	×			
Roezlii	New Granada				×								
russelliana	Brazil												×
vexillaria	Colombia					×	×	×					
Warscewiczii	Peru			×									
Mormodes:													
Colossus	Central America			×									
Mormolyce:													
lineolata	Mexico					×							
Nephelaphyllum:													
pulchrum	Malay Arch.										×	×	×
Oberonia:													
tahitensis	Society Islands											×	×
Octomeria:													
Bauerii	West Indies			×									
Loddigesii	„ „											×	
supra-glauca	Brazil			×								×	×
Odontoglossum:													
arnottianum	- - -										×		
astranthum	Tropical America						×						
Cervantesii	Mexico		×										
— var. roseum	„		×										
cirrhosum	Ecuador		×										
citrosmum	Mexico				×								
— var. roseum	„					×							
constrictum	Venezuela								×				
cordatum	Tropical America					×							
crispum	Colombia	×	×	×	×	×	×	×	×	×	×	×	×
cristatum	Ecuador												
— var. cristatellum.	U. S. of Colombia				×								
Edwardi	Ecuador		×										
grande	Guatemala							×	×	×			
hastilabium	„					×							

——	——	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Odontoglossum—*cont.*													
harryanum	New Granada				×								
læve	Guatemala					×							
lindleyanum	New Granada					×							
luteo-purpurem	,,		×										
maculatum	Mexico		×										
madrense	,,									×			
mirandum	New Granada			×									
nebulosum	Mexico	×											
Oërstedii	Costa Rica		×										
— var. majus	,, ,,		×										
Pescatorei	New Granada		×	×									
polyxanthum	Ecuador					×							
pulchellum	Guatemala	×	×										
Rossii	Mexico		×										
— var. majus	,,		×										
— var. superbum	,,			×									
sanderianum	New Granada			×									
schlieperianum	Costa Rica							×					
triumphans	New Granada		×										
Œceoclades :													
maculata	Pernambuco										×		
Oncidium :													
ampliatum	Central America			×									
auriferum	New Granada						×						
barbatum	Brazil										×		
bracteatum	Central America									×	×		
candidum	Guatemala						×						
cæsium	Tropical America					×							
caminiophorum	Caracas					×							
cheirophorum	Colombia											×	
cucullatum	New Granada			×									
— var. nubiginum.	,, ,,					×							
concolor	Brazil				×								
excavatum	Peru										×		
flexuosum	Brazil								×				
harrisonianum	,,				×								
hebraicum	New Granada					×							
heteranthum	Peru	×											

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Oncidium—*cont.*													
incurvum	Mexico							×					
isopterum	Brazil							×					
jamesianum	- -						×						
janierense	Brazil								×				
jonesianum	Paraguay										×		
lanceanum	Surinam					×							
Limminghii	Caracas						×						
longipes	Brazil						×						
luridum	West Indies			×									
microchilum	Guatemala								×				
micropogon	Tropical America								×				
ornithorhyncum	„ „									×	×		
ornithopodum	„ „					×							
obryzatum	Peru		×										
Papilio	West Indies		×	×	×	×	×	×	×	×			
pelicanum	Mexico								×				
pubes	Brazil		×										
pumilum	„					×							
retemeyerianum	- -							×					
sarcodes	Brazil					×							
splendidum	Mexico, Guatemala	×											
tectum	Colombia		×										
tigrinum	Mexico									×	×		
trulliferum	Brazil									×	×		
varicosum	„									×	×		
— var. Rogersii	„												
Orchis:													
foliosa	Madeira				×								
maculata	Europe							×					
mascula	„							×					
Ornithidium:													
album	West Indies									×			
coccineum	„						×						
Sophronitis	Colombia	×	×	×	×	×	×						
Ornithocephalus:													
grandiflorus	Brazil				×								
Ornithochilus:													
fuscus	Burma						×	×	×				

——	——	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Peristeria:													
cerina	Central America								×				
Phaius:													
albus	India				×								
Bensoniæ	Rangoon						×	×	×	×	×	×	
bicolor	Ceylon						×						
callosus	Java												×
Humblotii	Madagascar					×							
maculatus	India			×									
Marshalliæ	Moulmein					×							
pauciflorus	Java	×											
Wallichii	East Indies		×										
— var. Manni	Assam				×								
Phalænopsis:													
amabilis	Philippines		×	×	×	×	×						
amethystina	Sunda Islands										×	×	
buyssoniana	Cochin China								×	×	×	×	×
Cornu-cervi	Moulmein						×	×	×				
denticulata	Tropical Asia											×	×
gloriosa	Sulu Archipelago				×	×							
grandiflora	Java					×	×						
luddemanniana	Philippines		×	×									
Lowii	Moulmein									×			
sanderiana	Philippines				×	×							
schilleriana	Manilla	×	×	×									
stuartiana	Tropical Asia	×	×										
Pholidota:													
articulata	India						×						
chinensis	China					×							
conchoidea	Philippine Islands										×		
imbricata	India										×		
ventricosa	Java			×									
Physosiphon:													
Loddigesii	Mexico					×							
Platyclinis:													
Cobbiana	Philippines											×	×
filiformis	„								×				
glumacea	„				×								
uncata	„											×	×

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Pleurothallis:													
barberiana -	Trop. S. America -	×								×	×	×	×
cardiocrepis -	- - -												
carolinæ aff. -	- - -								×				
gelida - -	- - -					×							
immersa - -	New Granada -		×	×	×								
macroblepharis -	Brazil - -		×										
nutabunda -	" - -								×				
octomerioides -	Mexico - -											×	
ornata - -	" - -		×										
picta - -	Brazil and Guiana					×							
prolifera - -	" "											×	
pulchella -	Peru and Colombia									×			
semipellucida -	" "				×								
rubens - -	Brazil - -						×						
tribuloides -	Costa Rica -								×				
tridentata -	Venezuela - -	×											
velaticaulis -	Colombia - -									×			
velatipes - -	Venezuela - -					×				×			
villosa - -	Mexico - -					×				×			
wendlandiana -	Tropical America											×	×
Polystachya:													
laxiflora - -	Sierra Leone -	×											
leonensis - -	" " -							×					
grandiflora -	" " -							×				×	×
pubescens -	South Africa -	×											
purpurea - -	India -							×					
Pterostylis:													
Baptistii - -	Australia - -				×								
concinna - -	" - -							×					
nutans - -	" - -											×	×
Renanthera:													
bilinguis - -	Java - -								×				
coccinea - -	Cochin China -									×	×		
Restrepia:													
antennifera -	Colombia - -	×											×
elegans - -	Caracas - -				×								
ophiocephala -	Guatemala -		×										
— var. purpurea	- - -			×									
pandurata -	Tropical America		×									×	

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Restrepia—*cont.*													
striata	Tropical America		×										
Rodriguezia:													
fragrans	Brazil				×								
secunda	Trinidad								×				
Saccolabium:													
bellinum	Burma	×	×										
Blumei	Tropical Asia					×							
curvifolium	Ceylon				×								
gemmatum	Khasia Hills			×									
guttatum	Malay Arch.				×								
micranthum	India				×								
paniculatum	Himalayas							×					
Pêchéi	Moulmein				×	×	×	×					
Sarcanthus:													
insectifera													×
pallidus	India							×					
pugioniformis	Malay Arch.									×	×	×	
teretifolius	China									×			
Williamsoni	Moulmein							×					
Sarcochilus:													
Berkeleyi	Andamans				×	×							
luniferus	Burma	×	×										×
Satyrium:													
coriifolium	South Africa								×				
Princeps	„ „								×				
Saundersia:													
mirabilis	Brazil				×								
Scuticaria:													
Hadweni	Brazil							×					
Steelei	British Guiana						×						×
Sobralia:													
macrantha	Mexico				×	×	×						
— var. nana							×						
sessilis	British Guiana		×	×	×	×	×	×	×				
virginalis							×						
Sophronitis:													
cernua	Brazil										×	×	×
grandiflora	„	×									×	×	×
— var. rosea	„	×										×	×

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Sophronitis—*cont.*													
violacea	Brazil	×											
Spathoglottis:													
Fortunei	Khasia and Sylhet									×			
ixioides	Himalayas							×					
Vieillardii	Sunda Islands					×	×	×	×	×	×	×	×
Stanhopea:													
insignis	Brazil							×					
jenischiana	Peru							×					
grandiflora	Trinidad										×	×	
Ruckeri	Mexico									×			
platyceras	Colombia								×				
saccata	Guatemala						×						
Stelis:													
discolor	Peru								×				
muscifera	Venezuela			×									
Stenoglottis:													
fimbriata	South Africa								×	×	×	×	×
Tetramicra:													
bicolor	Brazil				×								
Thelasis:													
carinata	Malay Arch.								×				
Trias:													
picta	Burma		×										
Trichopilia													
fragrans	Colombia		×										
— var. nobilis	„	×											
galeottiana	Mexico							×					
laxa	New Granada												×
hymenantha	West Indies										×		
tortilis	Mexico				×								
Trichosma:													
suavis	Khasia Mountains										×		
Trichocentrum:													
fuscum	Mexico										×	×	
Trigonidium sp.	-			×									
Vanda:													
amesiana	Cambodia												×
Bensoni	Rangoon								×				

—	—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Vanda—*cont.*													
cœrulea	Sylhet, India								×	×	×		
cristata	Nepal				×								
insignis	Timor								×	×	×	×	
kimballiana	Tropical Asia									×	×		
limbata	Java					×							
suavis	"				×	×							
— var. Veitchii	"		×	×									
tricolor	"												
— var. insignis	"			×	×								
Wightii	India				×								
Vanilla :													
planifolia	Tropical America			×									
Xylobium :													
corrugatum	New Granada		×									×	
elongatum	Central America										×		
leontoglossum	New Granada	×											
Zygopetalum :													
cerinum	Central America						×						
citrinum	Brazil						×						
crinitum	"			×									
discolor	Costa Rica				×								
Gautieri	Brazil								×				
brachypetalum	"							×					
gramineum	Popayan				×								
intermedium	Brazil	×	×										
marginatum	Colombia										×		
Rollisoni	Brazil									×			
stapelioides	"						×						
velatum	Tropical America									×			
wailesianum	Brazil						×					×	
Totals for each	month	85	108	104	104	125	101	87	90	96	108	114	99

CXCIV.—DAMMAR FROM NEW CALEDONIA.

We have for some time had in the Museum of the Royal Gardens specimens of the wood and resin of a tree indigenous to New Caledonia, obtained by Professor Moseley, F.R.S., who communicated them with the following note :—

A gum from New Caledonia, obtained at Canala, on the east side of the island, by Mr. J. Brazier, and given by him to me.

With this is a sample of the wood of the tree from which the gum is collected. An incision made in the bark of the tree produces a copious flow of the gum.

The gum is soluble in alcohol, and burns with a pleasant odour.

Very large quantities of the gum might be readily obtained in the island if it were found suitable for varnish or otherwise.

The wood of the tree is commonly used for building purposes.

The bark and leaf of the tree are said to be like those of a *Dammara.*

H. N. Moseley.

We have been unable to get any further light on these specimens. But having recently obtained Sebert's "*Notice sur les bois de la Nouvelle Caledonie*" it seems possible with its aid to clear up the identification. A tree described as *Dammara lanceolata,* Lindley, and occurring "depuis Genguène jusqu'à la baie du Sud" (p. 169), agrees in every particular with Professor Moseley's note, while of the other two species of Dammara known to occur in New Caledonia, *D. Moorei,* Lindl., only occurs in the north, and *D. ovata,* Lindl., in the south.

It is, however, rather puzzling to find that Lindley had described no species under the name of *D. lanceolata.* Sebert, however, states, that in the descriptive botanical work of his book he was assisted by Pancher, and in the Kew Herbarium we have a specimen of *D. lanceolata* collected in New Caledonia by the latter, and communicated by Mons. Thozet, of Queensland. The species, therefore, if valid, of which we can hardly on the material form an opinion, must be called *D. lanceolata,* Pancher and Sebert. The authors mention that it abounds in resin, the value of which for commercial purposes never seems to have been tested. "The natives," he says, "use it to varnish their pottery."

It will be remembered that the Kauri resin of New Zealand is afforded by *Dammara australis,* Lamb.

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 52.] APRIL. [1891.

CXCV.—PERSIAN TOBACCO OR TOMBAK.

(*Nicotiana Tabacum*, L.)

A curious confusion has long existed as to the botanical identity of the tobacco plant cultivated in Persia. Flückiger and Hanbury in their Pharmacographia, one of the most accurate books ever published, remark (2nd ed., p. 469), "*Nicotiana persica*, Lindl., yields the tobacco of Shiraz." Bentley and Trimen, Medicinal Plants, vol. iii., sub. tab. 191, attribute Persian or Shiraz tobacco to the same species. These statements are adopted from the account and figure published by Lindley in the Botanical Register (tab. 1592). He says, "We are happy to "have the opportunity of laying before our readers a genuine figure "and description of the plant which produces the far-famed *Tobacco* "*of Shiraz.* The common Virginian tobacco is also cultivated in "Persia; but this it is from which the finest quality is manufactured. "Seeds of it were brought from Persia by Sir Henry Willock, upon "his return from his late residence at the Court of Ispahan, and communicated to the Horticultural Society, in whose garden it blossomed "in September and October last."

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
88 and 90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Twopence.

Dunal, in his monograph of the Solanaceæ in De Candolle's Prodromus (vol. xiii. 1, p. 567), adopts Lindley's species with the remark, "celeberrimum tabacum e Shiraz producit." Yet, of the half a hundred species of *Nicotiana* which have been described, only two are ordinarily grown for smoking, namely, *Nicotiana Tabacum* and the more hardy yellow-flowered species, *N. rustica*.

A curious fact to start with is that under *N. persica* Lindley has redescribed a well-known species. As Alphonse De Candolle remarks (*L'Origine des Plantes Cultivées*, 2nd ed., p. 115), "Lindley has "failed to observe that *N. persica* is precisely the same as *N. alata*, "figured three years before by Link and Otto (*Icones plant. rar.* "*Horti ber.* t. 32). This was raised from seeds sent by Sello from "S. Brazil. It is a species certainly Brazilian, nearly allied to the "Australian *N. suaveolens*. I am unable to offer an opinion as to "how this species has been introduced into Persia. It must have been "as a garden escape, or through seeds introduced by accident from "America. It is improbable that its cultivation is common in Persia, "for Olivier and Bruguière, as well as other naturalists, who have seen "the cultivation of tobacco in that country, made no mention of "*N. persica*."

The difference between the two plants is unmistakeable. *N. persica*, or, rather, *N. alata*, has white flowers, with a long slender tube, terminating in a nearly flat or salver-shaped limb, while the corolla of *N. Tabacum* is red, and funnel-shaped.

A *Nicotiana*, now much cultivated in gardens under the name of *N. affinis*, is probably only a cultivated form of *N. alata*.

As long ago as 1876 steps were taken to settle the point by procuring from Persia authentic seeds of Shiraz tobacco.

Mr. W. Taylour Thomson to Royal Gardens, Kew.

My dear Sir,
Tehran, 30th November 1876.

In accordance with a request received some time ago, I have much pleasure in sending you by to-day's mail a bag of the best Shiraz tobacco seed.

I have also received the instructions as to the sowing, watering, and growing them, but as there is no time in which to have them translated for sending by to-day's courier they shall be sent on by the first opportunity.

I am, &c.
Dr. J. Hooker, C.B. (Signed) Wm. Taylour Thomson.

The seed was grown at Kew, and largely distributed. It was undoubtedly "merely a form of *Nicotiana Tabacum*." This was stated in the Kew Report for 1877 (p. 40).

About ten years later attention began to be attracted to a mysterious article of commerce mentioned in consular and trade reports as *Tumbeki*, or *Tombak*. The following extracts are taken from an interesting paper by Mr. E. M. Holmes, F.L.S., the Curator of the Museum of the Pharmaceutical Society, printed in the Pharmaceutical Journal for February 13, 1886 (p. 681).

TUMBEKI.

Tumbeki is the name under which an article of regular commerce between Persia and Turkey is mentioned in the consular reports, especially in that for Trebizond.

Two or three years ago an inquiry was made at this institution concerning the nature and botanical source of *tumbeki*, and the only information I was then able to give was that in the "Treasury of Botany" tumbeky is stated to be the narcotic leaf of a species of lobelia.

From its frequent occurrence in the Blue Books in the same list with tobacco, and from the large quantities mentioned as an export from Trebizond, my correspondent suggested that it was probably something used for smoking like tobacco. In the hope that tumbeki might prove to be some drug possessing important narcotic or possible medicinal properties, I wrote to Mr. A. Biliotti, Consul at Trebizond, for information. In reply, he forwarded samples of tumbeki of different growths and qualities. This proved on examination to be unquestionably some kind of tobacco, and being puzzled to know why it figured in the Blue Book as a distinct article, I asked Mr. Thomas Christy, F.L.S., to make inquiries for me in Persia. He received the following note through Mr. Zanni, the well known chemist at Constantinople, from whom I received the following information :—

"There are three qualities of the *teymbeki*, all derived from the *Nicotiana persica*.

"1. Shiraz *teymbeki*, valued at twenty gold piastres per oke.

"2. Kechan *teymbeki*, valued at ten gold piastres.

"3. Teheran *teymbeki*, equal in value to No. 2.

"The Shiraz is the best quality, the leaves are four decimetres long and half a decimetre wide. The leaves of the two other qualities are not so large. The quantity of alkaloid in the leaves of teymbeki is more than in the leaves of *Nicotiana Tabacum;* it is much used in Constantinople, but more so in Egypt, Syria, and particularly in Persia. Teymbeki is smoked in a special apparatus known as the narghileh. The apparatus is found in every coffee house and even in a great number of private houses. It resembles somewhat the wash bottle used in laboratories for washing filters with distilled water, but is often made of metal. The *teymbeki* is placed in a small reservoir on the top of the flask and burns in contact with a piece of incandescent charcoal. The vapour is drawn through the tube, which passes to the bottom of the water and collects above it, whence it is inhaled through the longer tube. It is in fact a water-pipe."

Having ascertained then that *tumbeki* was a species of tobacco, I sought for further confirmation of the statement that it is the produce of *N. persica*, and wrote on the subject to Professor Hausknecht, who is well known as one of the best authorities on the botany of Persia. He kindly replied as follows :—

"*Tumbeki* is the produce of *Nicotiana rustica*, and is almost exclusively used for the water-pipes called kallian or narghileh. The plant is cultivated throughout the whole of Persia, especially in Ispahan and Shiraz, whence the best kind comes."

But the statement of M. Zanni that *tumbeki* contains more alkaloid than tobacco, and that of Professor Hausknecht that *tumbeki* is the produce of *N. rustica*, seemed to conflict with the statements in books that *N. rustica* is less active than *N. Tabacum*.

In the "Commercial Report," No. 25, 1883, p. 1056, under "Smyrna," Consul Dennis confirms M. Zanni's statement concerning tumbeki. He says:—"It is much stronger than ordinary tobacco, and cannot be "smoked in the usual way, therefore it is exclusively used for the "narghili." He also adds that a large quantity is consumed in the district of Smyrna, but much is also re-exported to Egypt and other parts of Turkey. It is imported from Persia, both through Trebizond and Bushire on the Persian Gulf.

Mr. J. B. Fraser, in his work on Persia (1826), remarks, "The "tobacco smoked in the kalian is called *tumbaku* in distinction to *tootoon*, "or that smoked in pipes or cigarettes. It is sold in the leaf, which is "packed dry in layers, and is preserved in bags sewn up in raw hide. "It improves by age, but is quite unsmokable the first year. The best "comes from Jaroum, south of Shiraz."

In an interesting article in "Harper's Magazine" (January, 1886, p. 224) on the "Domestic and Court Customs of Persia," the writer remarks concerning tumbeki: "The kaliân or water-pipe differs from "the Turkish narghileh by having a short straight stem. In it is smoked "the tobacco called tumbakee—a species grown only in Persia. That "of Shiraz is very delicate in flavour and is the best. The *tumbakee* "must be first soaked in water and squeezed liked a sponge or it will "cause vertigo. A live coal, made from the root of the vine, is placed "on the tobacco, and the smoke is drawn through the water with a "gentle inhaling, depositing the oil in its passage through the water."

The leaves of tumbeki which I have received from Trebizond and Constantinople both correspond with *N. persica* in character, but not with *N. rustica*, since they have no trace of a petiole. So far as it is possible to ascertain, therefore, in the absence of flowers, the weight of evidence is in favour of tumbeki being the produce of *N. persica*."

A sample of Shiraz *tumbeki* was submitted to chemical examination by Messrs. Ernest J. Eastes and Walter H. Ince (Pharm. Journ., l.c., p. 683), with the following results:—

Nicotine - - - -	5·835
Saccharoid matter - - -	3·355
Saccharoid matter after Pb treatment -	3·49
Soluble in water - - -	55·6
Insoluble in water - - -	44·4
Ash - - - - -	26·15

The following further account appeared in the Journal of the Society of Arts for August 9, 1889, p. 744.

PRODUCTION OF PERSIAN TOMBAK.

"This narcotic, which is known under the name of *Nicotiana persica*, is cultivated in Persia exclusively, in the provinces of Chiraz, Kechan, and Ispahan. Its quality varies with the place of production. The best *tombak* is that which is derived from Chiraz. The production of this province varies between 1,500 and 2,000 bales a year, which is almost entirely consumed by members of the Imperial family. The *Journal de la Chambre de Commerce de Constantinople* says that *tombak* of this superior quality is not very abundant, and the price paid for it is about fifty or sixty francs the oke, the oke being equivalent to 2·8 lbs. avoirdupois. The province of Kechan produces the second quality of Persian *tombak*. With small leaves like the Chiraz *tombak*, the product of Kechan is not even so abundant. The province of Ispahan is the centre of the product for exportation. Its cultivation is carried on on a large scale, and the plant, which has a large leaf, forms the third quality of Persian *tombak*. It has been vainly endeavoured to grow this plant in other localities of Persia and Turkey, and experiments which have been made in growing Chiraz *tombak* in the districts of Ispahan and Kechan have not been attended with successful results. This is attributed to the quality of the soil. *Tombak*, which is used in the same way as tobacco, is cultivated in a manner almost identical with that followed in tobacco cultivation. The seeds are sown in the month of May, and as soon as the young plants have attained a height of from fifteen to twenty centimetres they are watered once a fortnight. The harvest takes place in September or December, when the leaves are cut and spread upon the ground, where they are exposed to the dew for a period of forty-eight hours, and to this exposure they owe the fact of their being slightly stained with little black patches on the leaves. When carried to the warehouses the leaves are piled one upon the other. A slight smoking to which they are subjected in the warehouses gives to the leaves a greenish tint. The warehouses are then carefully closed so as to exclude all air, and at the expiration of a fortnight the leaves are sorted and packed. In the latter operation the following is the method employed:—After having separated the leaves one by one, they are placed one upon the other, and pressed in bundles of from forty to forty-two okes. They are then wrapped in pieces of American cloth, which are stretched and sewn up in the form of bales, called *torba*. These *torba*, which are covered with sheepskins, half dressed, are then ready for delivery to the trade. *Tombak* in good condition, packed in bales, and warehoused in places not too dry, may be kept without any deterioration for several years."

It seemed worth while, as the results of Mr. Holmes's inquiries had not proved absolutely conclusive, to make further inquiries. An application to Her Majesty's Legation at Tehran led to the following correspondence.

Dr. Casson to Royal Gardens, Kew.

Her Majesty's Legation, Tehran,
3rd March 1890.

Dear Sir,

I have to-day received your letter respecting the *tumbaki*. I was engaged at the moment in smoking some Shiraz *tumbaki*, which is by far the best to be found here, in my callian or water-pipe. My own impression is that it is simply a form of tobacco. I will do my best to obtain you seeds and leaves of each variety, and send them by messenger to the Foreign Office for you. I will also lay myself out to gather all possible information respecting the plant.

I am, &c.
(Signed) J. Hornsey Casson.

D. Morris, Esq.

Dr. Casson to Royal Gardens, Kew.

Tehran, 17th May 1890.

My dear Sir,

I send you herewith such information respecting Persian *Tanbaku* as I have been able to collect at present. Later on I hope to send you the specimens promised, and I also append information and specimens from the Ispahan district.

I am, &c.
(Signed) J. Hornsey Casson.

D. Morris, Esq.

TUNBAKU OR TUMBAKU.

Her Majesty's Legation, Tehran,
16th May 1890.

The following interesting particulars with regard to the cultivation, &c. of the tunbaku plant have been kindly furnished by the Nawab Haider Ali Khan, British agent at Shiraz. A translation, as nearly as possible literal, of the original Persian of his communication is here given. Hākān and Lars, from which the samples most in request by the higher class Persians come, are both in the immediate neighbourhood of Shiraz, from whence the Nawab promises to send in the autumn specimens of leaves, flowers, and seed, with samples of the soil and water. On receipt of these I will forward them at once to Kew. I append also an abstract of information on the same subject afforded me by Mr. Wright, the English head gardener of H.I.H. the Zil-é-Sultan.

J. HORNSEY CASSON.

[Enclosure I.]

About the beginning of February the seed is sown broadcast on the ground, which is first ploughed and reploughed two or three times, and well manured, mixed animal manures and nightsoil being used for this purpose. Ridges, about a yard apart, are made, and the intervening furrows are flooded, and while the water still remains on the ground the sowing takes place. One and a half "mands" (one mand = 6½ lbs.) of seed are used on the same extent of land as would be sown with five (5) mands of wheat. The seed sinks with the water into the ground, which is then covered thickly over with camel-thorn as a protection principally against birds. When the plants begin to show above ground they must be watered once a week, so that the ground remains slightly moist. Later on the watering must be continued every second week until about the 10th of April, when the thorn is removed. The ground is then weeded and bat and pigeon manure is scattered broadcast over it. About the commencement of May the transplantation into other ground is effected. Old fallow land should be selected; two consecutive crops of good *tunbaku* cannot be expected. The course generally adopted is to plant *tunbaku* one year, wheat the following, and the third year the land is left fallow. The ground must be reploughed four or five times and arranged in ridges and furrows (Pūshteh vé Lūleh), the latter being flooded, leaving the crests of the ridges dry. The transplants are then put in at the water-line about eight (8) inches apart, and a week later the ground is again flooded, which process is repeated the second time after an interval of two weeks, and again continued weekly until the plants attain the height of about one yard. The crowns are then cut off, leaving five or six good leaves. After the cutting, smaller leaves begin to sprout, and these must be cut away, the larger and thicker the leaves, the better the *tunbaku*.

At the middle of "Zibra" (about the first week of October), the maturity is known by the appearance of red spots on the leaves, which also crackle on pressure between the fingers. The ground is again flooded, and the plants are cut off near the root, the stalks being again stuck into the ground at the water-line, the leaves remaining dry above ground. When the prickles on the leaves are quite dry, the ground is once more flooded. Next day when the water has well subsided, and the mud is beginning to dry up, the plants are pulled up and thrown into the furrows, where they are left for about 24 hours. Before sunrise the following morning they are collected and removed into a shady place, *e.g.*, into tents, where the leaves are separated from the stalks as rapidly as possible before drying takes place. A pit about two yards square is made, and the leaves, arranged in layers, the stalks being placed on the top as a protection against the sun, are firmly trodden in. Ten to fifteen days later they are taken out and spread over the floor of a store-room, where they are well turned over for two or three days, and in this manner carefully dried. They are then closely packed into canvas bags, which are generally cased over with skins for protection during transport. Tobacco seeds of cold countries will grow in hot climates, and vice versâ. The points most to be considered are the water, soil, and climate. In all good *tanbaku* districts either the water or the soil, or both, are brackish or salt (shūr). The peculiar aroma most appreciated by Persians is only to be obtained by growth in warm climates. The produce from the non-brackish districts is exported and not relished for home consumption. *Tūtūn*, pipe tobacco, and *tanbaku*, are two different plants, but the cultivation is the same. *Tūtūn* can never become *tanbaku*, or *tanbaku*, *tūtūn*. In a good year 10 paimans of land (one paiman = 100 square yards) will yield one thousand (1,000) to twelve hundred (1,200) mands of *tanbaku*.

(Signed) HAIDER ALI KHAN of SHIRAZ.

Shiraz, April, 1890.

[Enclosure II.]

Mr. Wright, late head gardener to his Imperial Highness the Zil-é-Sultan, considers that *tanbaku* is the ordinary tobacco plant, and that the difference between the *tūtūn*, used principally in this country for cigarettes, and *tanbaku*, used for smoking in the *ghkāliān* or water-pipe, consists in the fact that the *tūtūn* is almost exclusively grown in the moister climate of the Resoht and the rice-growing districts. The *tanbaku* is produced in a very dry district, where dew is absent. The leaves are stripped before they become yellow, laid out singly to dry in the sun at about 140° Fahrt., and then closely packed into skins. The Shah's *tanbaku*, which is of a specially fine quality, grows in a very limited district known as Hakūn or Hākān, at the foot of the mountains some 14 miles from Shiraz. This ground is irrigated by a stream of very brackish water (Āb é shūr) and the natives attribute the superiority of this particular sample entirely to that cause. Cotton and grapes grow to great perfection in the same region. This peculiarity of water greatly affects other products, for instance, at a place a few miles from Ispahan, melons of a specially luscious flavour are found, the seeds of which, sown in the garden of the Zil-é-Sultan at Tehran, where the water is sweet, produced melons entirely devoid of their native distinctive flavour. The inhabitants of the district are well aware that the same melons cannot be produced elsewhere, and attribute this circumstance entirely to the water, which is so strongly impregnated with salt as to be undrinkable. After the *tanbaku* is packed in the skins no fermentation takes place. As required for use the leaves are taken out and beaten with a sharp-edged mallet. The broken leaf is then sifted, the coarse pieces, such as the ribs, and the snuffy dust being rejected. The preparation of the *ghkāliān* for smoking is a work of some technical detail. The *tanbaku* is moistened with water and then pressed, *secundum artem*, into the *ghkālīān* "head" not too tightly or too loosely. Live charcoal is then placed on the *tanbaku* and the pipe is ready, the smoke being drawn through the water in the body of the pipe into the mouth of the smoker.

(Signed) J. HORNSEY CASSON.

Tehran, 16 May 1890.

Dr. CASSON to ROYAL GARDENS, KEW.

MY DEAR SIR, Tehran, 24th December 1890.

THREE days ago I received from the Nawab Haider Ali Khan of Shiraz, the promised specimens of fruit, flower, and seed from the Shiraz district, which I have much pleasure in sending on to you, through the Foreign Office. I hope our messenger will make his way safely over the mountains to Rescht; there is a very deep snow, and at an altitude of some 12,000 feet it is no easy or safe journey. A year ago I was lost at the highest spot for eight hours in a snow drift, having under my charge a poor widowed lady, with her two young babies, on her way home after the death of her husband. On that occasion our courier lost the dispatch bags for four days in the snow! However, I hope these specimens may reach you safely and be useful. I have not translated the writing on the packets, as they are only the addresses of the Nawab at Shiraz; each of the bags, however, is inscribed *Tockhin é Tunbaku*, "seeds of *Tumbaku*." So you may depend upon the authenticity of the specimens.

I shall be interested to hear the result of your researches.

Yours, &c.

D. Morris, Esq. (Signed) J. HORNSEY CASSON.

The material sent by Dr. Casson required a good deal of soaking and manipulation before it could be brought in to a form in which it could be compared botanically. This, however, having been done, the conclusion was incontestable that the plant of the Shiraz *tunbaku* was nothing more, as had indeed been expected, than ordinary *Nicotiana Tabacum*.

CXCVI.—BOTANICAL ENTERPRISE IN THE NIGER PROTECTORATE.

The following geographical account of the Protectorate is extracted from the Colonial Office List for 1890, p. 299:—

"The British Protectorate over the entire basin of the Lower Niger, including the Benin and Cross Rivers, was formally assumed in July 1884, when regular treaties of protection were concluded by Consul Hewett with all the principal Chiefs. It extends along the coast of Africa from the Benin River (where it joins the boundary of Lagos), to the mouth of the Rio del Rey at 9° east longitude. Inland, the Protectorate includes the whole basins of the Lower Niger and Binué up to and beyond the Boussa rapids on the former, and Jin on the latter, in about 10° north latitude. * * * * The whole of these vast districts are under the general supervision of the British Consul for the Bights of Benin and Biafra, but on the 10th of July 1886 a Royal Charter was granted to the Royal Niger Company (formerly the National African Company, Limited), by which extensive powers of administration were conferred upon them in the territories over which they have treaty rights, including a belt of 30 miles on each bank of the Niger and Binué. The operations of the Company extend as far inland as Gando and Sockatoo, with the Sultans of which countries treaties have been concluded. The Company's operations on the sea coast are mainly confined to Akassa, the Nûn entrance to the Niger."

The original trade both of the Niger Protectorate and of other West African possessions was in the natural products of the country. As long as this was the case European occupation was practically limited to the trading stations on the coast. As the interior has, however, been gradually opened up there has been a marked disposition to utilise its physical resources in the growth of every suitable kind of tropical produce. It is upon the development of this policy that the material progress and peaceful prosperity of these countries must ultimately depend.

The *Kew Bulletin* for September 1890 contains (pp. 195–199) a memorandum drawn up by the Assistant Director, in the first instance for the Royal Niger Company, but subsequently somewhat expanded so as to cover the cultural industries of West Africa generally.

The Royal Niger Company has on various occasions applied to Kew for assistance in turning to commercial account the natural products of its territory, many of which were little known in trade. In 1889 it was supplied with two picked men, George Woodruff and Harold Edmund Bartlett, from Kew, to take charge of the botanical stations which it had established in the interior.

The gardeners at Kew are specially trained to fit them for such appointments. The Royal Gardens have, in fact, always been an advanced technical school. Each gardener is admitted for a two years' course, during which he has the opportunity of seeing every kind of cultivation carried on in the establishment, and in addition obtains systematic instruction in scientific subjects connected with his profession. The best men receive appointments as opportunity offers, and they are now to be found in every part of the world.

It has always been the practice to keep up as far as possible an informal correspondence with the Kew men abroad and in the colonies. The moral influence of feeling that there are people at home who take an interest in the details of their work, and their success in performing it, is obvious; and Kew can materially smooth matters for its *alumni* when they find much in the conditions of horticulture in the tropics that is strange and unfamiliar to them, by giving the advice suggested by long experience in dealing with such difficulties.

In the case of the two men sent to the Niger Protectorate, the Royal Niger Company unfortunately set its face against their carrying on a correspondence with Kew. This seemed a short-sighted policy, as the Company had obviously everything to gain by such assistance as Kew could give to the men in its employ.

Both men unhappily have died, the last at the commencement of the present year. No blame, however, of the slightest kind can attach to the Royal Niger Company for this untoward result. It is evident that it did everything in its power to promote the health and comfort of the Kew men.

But it seems only just to place some account of the work in which they perished on record. If Kew sent them to Africa where they met their death in the attempt to do something to extend the resources of the empire, it may at least rescue their names and memory from complete oblivion.

The letters printed below were, as will be seen, not in any way official but were addressed to former fellow gardeners at Kew. They are interesting as showing the type of men that the Royal Gardens turn out; the plucky way in which they face their difficulties, their loyalty to their employers, and the kindly feeling they entertain towards Kew. Beyond the omission of purely private matters, the letters have not been edited in any way.

ROYAL NIGER COMPANY to ROYAL GARDENS, KEW.

Surrey House, Victoria Embankment, W.C.,
24 January 1889.

DEAR SIR,

SOME time ago you thought you might be able to find for us an intelligent young gardener who would be willing to go out to the Niger territories to take charge of the botanical work at Asaba. We have, during the past year, made as considerable progress as could be expected without the assistance of a trained gardener. If you could now recommend me anyone I should be much obliged. Perhaps you could suggest the terms on which he would go. His residence would be at Asaba, where there are a considerable number of Europeans, as it is the seat of the Supreme Court of the territories, and also the head-quarters of the constabulary force, which is officered by Europeans. It is reputed to be one of the healthiest places in the Niger territories, so that any candidate for the post should be informed that the climate is entirely different to that of the swamps of the West Coast.

I am, &c.
(Signed) GEORGE TAUBMAN GOLDIE.

D. Morris, Esq., M.A., F.L.S.

ROYAL NIGER COMPANY to ROYAL GARDENS, KEW.

Surrey House, Victoria Embankment, W.C.,
31 July 1889.

MY DEAR SIR,

MR. THISELTON DYER and you will be glad to hear that Woodruff is getting on capitally at Asaba, and seems to take great interest in his work. Do you think you could find us a second man of about the same calibre? We should be so greatly obliged if you could.

I send you a copy of our annual report to our shareholders, so that Mr. Thiselton Dyer may see that we have not forgotten to make our acknowledgments to him for his kindness.

Yours, &c.
(Signed) GEORGE TAUBMAN GOLDIE.

D. Morris, Esq., M.A., F.L.S.

EXTRACT from the Annual Report of the Royal Niger Company for the Year ending 31st December 1888.

WITH the valuable assistance of Mr. Thiselton Dyer, Director of the Royal Gardens at Kew, the Council have established a public botanical plantation, on a small scale, at Asaba, where experiments in the commercial botany of the territories are conducted, and from which it is intended that suitable plants and seeds may shortly be supplied at a moderate price to native and European cultivators and settlers. They have also established in the neighbourhood of Abutshi a second experimental administrative plantation for the growth of coffee and cocoa, for the purpose of similar distribution to all who may desire to cultivate those products.

ROYAL NIGER COMPANY to ROYAL GARDENS, KEW.

Surrey House, Victoria Embankment, W.C.,
19 September 1889.

SIR,

I AM desired by Sir George Goldie to ask you to be good enough to inform Mr. Thiselton Dyer that while the plantation No. 2 at Abutshi, to which Mr. Bartlett is specially going, and which contains a large quantity of cocoa and coffee plants, is very successful, the experimental plantation No. 1 at Asaba, in charge of Mr. Woodruff, has so far not proved satisfactory owing to the too great dryness and lightness of the soil at the latter place. Instructions have therefore been sent to the Agent-General to transfer plantation No. 1 as soon as possible from Asaba to the more loamy soil at Abutshi, rather lower down river and on the opposite side, where Mr. Woodruff will manage it as heretofore. Mr. Woodruff and Mr. Bartlett will thus be close neighbours, and will have the advantage of each other's mutual advice, while each will have his independent plantation to look after, and will thus be spurred on to make it a success.

Meanwhile, as the failure has largely affected the tobacco plants, Sir George Goldie will be greatly obliged if Mr. Thiselton Dyer could kindly supply a second set of tobacco seeds similar to those already sent, and of which I append a list.

I am, &c.
(Signed) FRED. W. BRETT.

D. Morris, Esq., M.A., F.L.S.

LETTER from H. E. BARTLETT.

c/o Royal Niger Company,
Akassa, West Coast of Africa,
November 3, 1889.

DEAR ——,

I WENT ashore at Sierra Leone, as you know I intended doing, and I found much to my surprise that the place is very different from what I imagined it to be. A hundred years and more of British rule have had their results, and, as a consequence, Sierra Leone boasts of many of the refinements of civilisation; artisans and mechanics of all descriptions ply their respective trades; and in the stores and shops nearly everything is obtainable. The price charged is not nearly so exorbitant as might be supposed, although some articles run expensive. Thus, a watchmaker charges 2*s.* for putting in a fresh glass, and a poor glass at that. A glass of lemonade ran me 9*d.* The population is of course all black. There are a few resident whites, but black par excellence is *the* colour, and there is quite as much difference between the "classes" as is observable at home. The educated natives speak English beautifully. A lawyer came on board and went as far as Cape Coast Castle, and it was a positive pleasure to hear that man speak; and he, in colour, was almost ebony black. I was disappointed in my wish to see Mr. Lewis (who has formed extensive plantations here), as he is still in England. I visited what is by courtesy termed a Botanical Garden. It is situated some distance from the town, and is the most abject, forlorn, and neglected looking place it is possible to conceive. It is, in fact, a barren wilderness, unproductive, uninviting. On my way I saw hundreds of those black ants similar to those that came in a Wardian case to Kew some time ago. They are very venomous. The rains here are very heavy, a fact sufficiently indicated by the deep gullies and watercourses which are everywhere to be seen. I had some personal experience of their character, for it being yet the rainy season I encountered one tremendous driving storm of rain in going back to the ship.

After leaving Sierra Leone we kept the coast continually in sight, and many times I thought of Monteiro's description of it in his book, "Angola and the River Congo." The coast-line is low, flat, depressing; no hills or cliffs rise to break the dreary monotony, and this coast is washed by a tremendous surf; a long white line of breaking surf being visible for miles. The next place I went ashore at was Accrá (accent on the second syllable), and here I had the extreme pleasure of landing for the first time on a surf-beaten shore. The sensation is grand, exciting, perilous. The surf boat shoots suddenly into the midst of the boiling surf. The natives seize you and bear you on their shoulders high and dry to the beach. I have not much to say about Accra. It is made up principally of native mud huts, with the addition of some houses of European residents. I paid a visit to the Rev. Mr. Freeman, a retired missionary, who, at one time, was a gardener in England. He is now living in patriarchal style, surrounded by children and grandchildren. In his little garden he has vines, tomatoes, garden egg, cabbages, parsley, and other things growing more or less luxuriantly. Tomatoes flourish abundantly. After leaving Accra the coast-line got lower, more flat and depressed than before. Here and there, at scarce intervals, little mission and trading stations showed like oases in the surrounding dreariness. Looking at this interminable monotonous prospect one sighed for the bold cliffs, the verdurous hills and pleasant smiling valleys of Madeira; lovely Madeira, "where every prospect pleases and only man is vile," and man is sometimes very vile in this earthly paradise.

It was on Wednesday, October 9th, that I landed at Akassa. The passage out was a quick one, occupying 26 days, and was not marked by any episode of more than usual interest.

Akassa is the depôt through which everything passes on its way up river. It consists of two dwelling-houses, one for the white men and one for the black clerks, and a long line of stores, and a billiard room. Here I spent 10 days, waiting to be sent up river, and on Sunday, 20th, I started on board the steamer "Kuka." The river Niger was now at its full tide. It was the close of the rainy season, and the river had risen 40 feet from its level in the dry season. The Niger delta covers an immense tract of country, and all this district was in a state of inundation; enormous volumes of water rushing out by every availing creek and river, and it is here that the mangrove swamps abound. The mangroves give a weird, fantastic appearance to the jungle; their white interlacing stems and roots forming an impenetrable barrier, through which no human being could force his way.

The navigation of this delta is very difficult, very intricate. The creeks run into each other and communicate in every imaginable manner, forming a maze, a network of water-ways through which it takes a careful pilot and an experienced one to find his way. A stranger entering these creeks without a trustworthy pilot must inevitably be lost. While I was staying at Abassa the British man-of-war, the "Alectro," came in to go up the river on some diplomatic business, and a captain of one of the Company's boats was sent as pilot.

As we went further up the river the vegetation slowly changed its character. The country still continued level, but in place of the mangroves, which almost wholly prevailed when we started, cocoanut and oil-palms (*Elœis guineensis*) began to make their appearance, and as we proceeded the giant silk-cotton tree (*Bombax*, sp.) reared its colossal head high above the surrounding vegetation.

While the Niger flora seems to be wanting in that lofty grandeur which one almost involuntarily associates with the tropics, yet the compact and dense masses of palms, alternating and intermixed with trees of a sturdier habit, from whose branches hang pendant climbers, give the scene a charm peculiarly its own. The eye looks in vain for a bold striking effect, and is, perforce, content to pick out and admire the individual beauties of leaf and frond and stem.

After getting past the creeks of the delta, we emerged into the Niger proper. Here the true width and volume of the river was at once manifest. We were on a rolling, rushing flood, of width varying from two to six miles. Not a bank to be seen. They are all covered by the expanse of water. Like a huge lake the river looked, and hurrying on to split up and divide itself among the countless creeks that compose the jungle delta, and thence ultimately to find its way to the sea. It is while the river is at this flood that banks are swept away, and even native towns entirely obliterated. The native always builds close to the water, for here he grows his little plantation of yams and plantains, and does his little fishing. It was about the second day that I for the first time understood what a tornado really meant. The steamer was towing a steam-launch which was moored amidships. In it were three men. In the middle of the afternoon a tornado struck us with fearful and unexpected fury, making the ship to reel and lifting all light articles and popping them overboard. The fury of the wind and rain was terrible. Suddenly there came a dreadful cry from the side and rushing over we saw the steam-launch rapidly sinking. It was incredible the quickness with which she went down. Two of the men managed to scramble on board, but the third, the engineer, was washed away. The surf-boat was at once manned and sent after him, but the poor fellow was lost. The rain fell in torrents. Within 15 minutes from the commencement the tornado ceased, and all was over.

It took three days to get to Abutshi, where I am at present. I found Woodruff here. He has shifted from Asaba, as the latter place is totally unfit for a botanic station, the soil being mostly sand. Consequently he has started here, and has made good progress. The plants and seed I brought out arrived in excellent condition except *Eugenia malaccensis*, which had lost all its leaves. As we have others, that will not matter. There is not as yet much variety in the station, but time will improve all that; coffee doing very well; cocoa fairly. *Bixa orellana* (Arnotto dye), cotton and jute, all seem to take kindly to the soil. I am staying here with Woodruff at present, as before said, but we shall not be together for long. Plans are not definitely settled yet. The work of the day commences early out here, and also all over the West Coast. At half-past 5 the bell rings and all the "boys" (boys is the name general to all the black labourers) turn out and work until 10, when they stop an hour for "chop," turning to again at 11 and working on till 6 p.m., when the bell rings. That, in effect, means working from dawn to dark, as it is soon dark after 6 p.m.

We have to keep much the same hours, but having a little different arrangement for meals; thus, after turning out the boys, or before, if we prefer it, there is early tea. Breakfast at 10, lunch at 2, and dinner at 6.30. So far I like the life very well. Of course there is always the contingency of fever to guard against. I had my first attack last week, but it was soon over, and in two days I was out in the plantation again. The worst time of the year is now approaching, the dry season.

* * *

Limes, the fruit of *Citrus acida* are largely used for making lime drinks, which are both cooling and refreshing. I must close up my letter within the compass of this sheet, or I shall exceed the half oz. postage, which I must ask you to pay this time. I hope to alter this state of things when I send again. We have no stamps here. You will see I have written to both of you, that will save postage, especially as you live together. Please remember me to K———, and show him this letter.

H. E. Bartlett.

Letter from H. E. Bartlett.

c/o Royal Niger Company,
Akassa, West Coast of Africa,
March 16, 1890.

My dear ——,

I must thank you very heartily for your interesting letter with its news of Kew and Kewites. Oh! the palmy days at Kew as you are so fond of remarking.

I was very much gratified and flattered by the invitation to write a paper for the Kew Gardeners' Mutual Improvement Society, and should like to have done so, but for three sufficient reasons could not.

Firstly. I did not get your letter until nearly February, thus not leaving time.

Secondly. I was in a very precarious state of health at that time and had been for two months. I did not lay up at all. I superintended all my little operations and works all the time, yet I had a terrible struggle with the climate. I kept up a stout heart and pulled through, but was near going under.

Thirdly. And more particularly I do not know to what extent I might compromise myself by writing home any account of the territories or Company's doings. My agreement talks glibly of heavy fines, as you know.

Well, I suppose you will be interested in my welfare, and so will try to let you know how I am getting along. I have got about 1,000 acres of land which has to be all opened up and planted. The name of the plantation is the N'Kisi Creek Plantation, so named after the N'Kisi River which runs through it. I have nearly 100 men at work on the estate at present. Labourers from Lagos, men very ignorant, who have to be shown everything. I am living on the plantation in my own house built by myself; that is, by my men under my directions. The house has two rooms, and verandah running all round. The walls are of mud, the floor ditto, and the roof of palm leaves (*Raphia vinifera*), prepared for that purpose. The rafters are of mangrove wood. At the back, but separate from the house, is the store-house, bath room, kitchen, and servants' room. I have two servants, both black—cook and house-boy. At the back of this, again, I have a little garden, in which I have planted peppers (Chilis), tomatoes, the Granadilla, sour sop, the Papaw, &c.

So you see my domicile is composed entirely of native materials. The palm leaves are fastened on with "tie-tie," a kind of cord or rope obtained from *R. vinifera* in common with the mats. It is a jolly house, situated on the top of a hill, with a splendid clear view of the Niger, from which a breeze frequently blows. It is always cool and comfortable in the house even under the fierce glare of the noonday sun. I am as comfortable as a king, and as happy as a sand boy, always remembering the sage axiom of Carlyle that happiness is obtained not so much by increasing your desires as by reducing them. I am now enjoying very good health, and can pummel the recalcitrant members of my crowd with ease. Living alone as I do, away from the stations amongst my crowd of "boys" (boys is the term used indiscriminately when speaking of labour here), men who are unscrupulous, and would take the instant advantage of their boss if it is possible, it is necessary to keep the whip hand of them, to be firm and *be* master.

I have learnt many things during my short sojourn in this land of Goshen. I have had to work pretty hard nearly the whole of the time I have been out. I work for my own credit you understand. I want to keep up the good old name of Kew, too, if I can. We are early birds. We turn out between 4.30 and 5. At 5 I have coffee and a snack of something. At 5.30 I ring the bell, and the day's work commences virtually with daylight. The men work on until 11, and turn to again at 12, working until 6. I have breakfast about 11, and dinner at 6.30, and 8 o'clock is time to turn in.

I am dreadfully busy just now. About 20,000 coffee and cocoa plants and 130 pods of cocoa seed arrived three days ago from Lagos as a first instalment for plantation, and there are more coming; that means business. We are going to do our level best to make the estate a big thing. I am pretty well armed in case of trouble any time. I have 21 rifles, a revolver, and about 400 cartridges by me. This morning being Sunday I had a little shooting practice; I am getting to manage the revolver very nicely. Rifles are not new to me.

With regard to climate, just now it is comparatively cool, as there are rains and tornadoes; but until quite recently it has been blazingly hot. The heat in the middle of the day is simply immense. I never stray far from the house or expose myself to the sun at any time without wearing my pith helmet. People at home may scoff at the helmet, but it is with the majority an indispensable article in the tropics. I could not stand the sun a day without my helmet.

Another matter will interest you. When I left England I was a teetotaller and a non-smoker. I am neither now. 'Tis true I drink scarcely anything; it is not obtainable. I do not think a man is any better in the tropics for teetotallism; abstinence by all means. Smoking also, in some degree, mitigates the plagues of Egypt as represented here by mosquitoes and sandflies.

The plants I took out are doing very well. The coffee plants at Abutshi are very promising. Cocoa and cotton likewise show up well. Woodruff is planting *Sansevieria* hemp now. I have been looking after the two places lately. Woodruff has been away after coffee and cocoa plants and seeds. Going to Lagos, Fernando Po, &c., &c., I travel by water, per canoe, but occasionally ride. You remember in the economic lectures, Jackson [Curator of the Kew Museums] said that the mango fruit tasted of tow and turpentine. Well, there is a decided flavour of those ingredients; but for all that the fruit is delicious. I am *great* on mangoes; the turpentine taste is only just as you bite the fruit; as soon as you have got a fair grip you lose the initial bad flavour.

The sour sop is a favourite fruit of mine, with its acid taste. I do not object to a pine-apple now and then. It would surprise you to see the reckless way we knife a pine. I have half a dozen hanging in my verandah now; they are very nice. The Niger region, as represented by this district, is not a gay place at all. Nature wears a somewhat solemn face; and there are not many flowers wasting their sweetness on the desert air. There is a striking lack of both flowers and fruit. In out of the way shady, watered creeks and bush many beautiful flowers have their home, but these require searching and finding. I hope to make some contributions to Kew after I have "written my name" on the plantation.

It is now Wednesday, March 26th. I must try and finish your letter. I am just a trifle busy now, having received 25,000 coffee and 10,000 cocoa. You can have no idea how densely stupid the average African is, and how incapable he is of reasoning from cause to effect. My plantation hands are from Lagos, and they know not the use of any tool. It is amusing to see them handle a spade for the first time. I have got them, or rather some of them, to turn a piece of ground something near the mark. Yet, for all, like Mark Twain's jumping frog, they have p'ints.

It is curious how quickly they succumb to slight sicknesses. It is not skulking altogether, as they lose their pay when not working. At turning-to time I generally find half a dozen—sometimes more—sick men squatting on my verandah. They all come to me when sick. I give them salts largely, on the principle that if it does them little good it also does little harm.

I have had a lot of African fever since my arrival in this country, but I have never had a real knock-me-down attack. The fever is quick in its action. You feel heavy and tired; then you may or may not be taken with the *cold stage*, shivering and shaking, although the temperature is over 90° in the shade. This for an hour, or several hours, and it gradually passes off, leaving you in the hot stage. You are now burning hot and dry, not a drop of sweat about you; you fall into a semi-unconscious state, and awake to find yourself beginning to perspire. The whole business is over in about four hours, but it leaves a man very weak. Last week I had the fever, as described, three days following.

H. E. Bartlett.

Royal Niger Company to Royal Gardens, Kew.

Surrey House, Victoria Embankment, W.C.,
11 July 1890.

Dear Sir,

We annex copy letter from our Principal Medical Officer in the Niger Territories, giving particulars of the death of Mr. H. E. Bartlett.

Yours, &c.
(Signed) J. M. Macmorran,
For the Royal Niger Company,
Chartered and Limited.

PRINCIPAL MEDICAL OFFICER, Niger Territories, to ROYAL NIGER COMPANY.

Medical Head-quarters, Asaba,
18 May 1890.

MY LORD AND GENTLEMEN,

I AM very sorry to have to inform you that Mr. H. E. Bartlett, of the Onitsha Plantation, died on May 16, 1890.

Cause of death: Remittent fever; uræmia; exhaustion.

The fever was of a very severe type, known on the coast as blackwater fever, *i.e.*, a form of remittent fever in which one of the leading symptoms is the passing of urine of a port wine, or nearly black, colour. I was in constant attendance on him, and was with him when he died.

He was buried by the Rev. H. H. Dobinson, of the Church Missionary Society, who saw him more than once before he died.

I am, &c.
(Signed) W. H. CROSSE,
Principal Medical Officer,
Niger Territories.

The Royal Niger Company,
Chartered and Limited.

LETTER from G. WOODRUFF.

Botanical Plantation, Abutshi,
Niger Territories,
20 May 1890.

DEAR ——,

YOU will have heard before this of Bartlett's death, I had just left him and gone back to Abutshi, and was busy reading your kind and welcomed letter when the doctor sent to tell us. I never expected he would be out here long, but I thought he might get home again. He was sick nearly all the time he lived. Our work is very trying out here, having to be out most of the day. All other Europeans never go out but very little in the hot part of the day; but until we are well established it will be nothing but hard work, and unless a man is a thorough practical gardener he will find it very hard here, as everything is from the commencement; it is very different to going out to a place already made for you, and it takes very little worry to make you sick here.

It will not be so hard in two or three years time. It is not only knowing your work, but you must know how to manage men and be able to teach them, as when you get them they cannot use a spade or anything. I have it hard now, as I am one day at my own place and one at the other. I am pleased to say I am getting my plantation to look a little like a botanic garden. It is about 8½ acres, and by the end of this year I hope to have it most all planted. When the Earl of Scarborough was here he came through the plantation. He said I had done wonderfully well in so short a time, and that it was better than Lagos Botanical Station, or anything he had seen since he left Madeira, and the plants he said were looking well; he had never seen, taking the plants all round, anything looking so healthy. While I was at Lagos for plants, I paid a visit to the Botanical Station, and was well received by Mr. McNair, the Curator. It looks to be about 3½ acres.

We also went to St. Thomas's Island for coffee and cocoa plants. I did not see much of the island, but the flora appears to be similar to the Niger. We have about 23,000 coffee and 27,000 cocoa to be planted this year at the new place Bartlett started. I have collected about 4,000 *Sansevieria guineensis,* and planted them; the leaves grow quite 5 feet long, and produce splendid hemp. They are difficult to get, as they are only found here and there like most things out here. I hope some day to have a good turn in the bush, but I am afraid it will be some time before I shall have time enough to go properly into it, so that you must not expect much from me at present. The only things we have not been very successful with are *Cephaelis Ipecacuanha* and *Vanilla planifolia.* During the time I was away for plants they went back; I have just got them round again, and hope they will do better. Tea grows well here; at present we have the six plants sent out of Assam, and I have 12 cuttings struck. They grow without any shade, and keep nice and green Some of them have made 1 foot of new growth in a month, which I should think was good. We have nearly two hundred of *Piper nigrum* and the Patchouli about the same. *Piper longum* grows very slowly, and will not suit here at all. I have had some seeds from Lagos; they are all up, and some planted out—Bauhinias, Sesbanias, Acacias, *Salvia coccinea,* &c., which will help us in the flower way, but nothing of much value. We are just about commencing the rainy season, when everything must be planted out to be able to stand the next dry season. I expect we shall have to start a cotton plantation this year; I have sent home a sample, although not a good one, as they were late being sown, owing to my shifting from one place to another, and they had not finished their growth when the dry season set in. The tobacco from seed of our own saving from the few plants I managed to bring from Asaba, have done much better this time, and I hope this year we shall get some fine leaves. If we succeed, we can grow two crops in the year. I find that as we get the ground worked more, stones begin to appear; so I expect as we go on we shall have plenty by-and-by. If we get a good lot of stones to keep the soil open a little, we shall be able to grow almost anything. The coffee that we put in last year has flowered a little, and I hope next year to get enough from them for seed. I have this year put in 15,000 seeds to be put out next year; they are coming up very well, so far. They take six weeks to germinate, and in that time they have so many chances of being washed in by tornadoes, &c.

The first part of this letter I wrote while at the other plantation.

At Abutshi, where my garden is, we have plenty of company, as it is the depôt for everything going up or coming down the river, so that everybody going up or coming down stops here, so that there could not be a better place for a botanic garden, and we are always six in the house, and all very nice men. We live well, better than what you would think in so wild a country. We have coffee at 5.30 a.m., breakfast 10 a.m., luncheon 2 p.m., dinner 6.30 p.m. We have very little expenditure; even our washing is done, for a washman is kept on the place. I saved 100*l*. during my first year, and I expect there are few places going nowadays where you can do that.

The other plantation is quite away from anybody; you have your own house steward, cook, &c., &c., and are master of your own house, and when it is all planted it will be a fine place. The house is built about 100 feet above the river and ought to be healthy. It is when you have to live down among the swamps that it is so trying; altogether, a man can be quite happy out here if he keeps his health. A little sickness out here pulls one down very much.

The way I shade my nursery is this: I have beds made 4 feet wide, leaving a walk 3 feet between each. We then get forked sticks about 3 feet out of the ground, tie bamboos right along the forked sticks; then put bamboos across the top, and cover with palm leaves, Then, when you want to harden anything to the sun after they are up, just take a few palm leaves off every day or so till they are exposed altogether. They being built so low, a tornado never blows the leaves off, and now that I have had a year here, and know what weather to expect and the best way to sow things I am very successful. I have succeeded with everything I have put in this season so far.

I have not been able to dry any specimens yet, but we have just built a tool shed, seed room and office, so that I hope to dry some next flowering season.

G. WOODRUFF.

ROYAL NIGER COMPANY to ROYAL GARDENS, KEW.

Surrey House, Victoria Embankment, W.C.,
February 6, 1891.

DEAR SIR,

I AM instructed by Lord Aberdare to send you full information as to the regrettable decease of Mr. Woodruff, the gardener from Kew, of which the Company received news by cable on the 19th ult. The written information in question will probably arrive about a fortnight hence, when I shall at once forward it to you.

At present the Company has no news beyond the two words, "Woodruff dead."

Yours, &c.
(Signed) HENRY MORLEY,
Secretary.

W. T. Thiselton Dyer, C.M.G., F.R.S.

ROYAL NIGER COMPANY to ROYAL GARDENS, KEW.

Surrey House, Victoria Embankment, W.C.,
16th March 1891.

DEAR SIR,

I AM instructed to inform you that we have this day received the annexed reports of the regrettable death of Mr. Woodruff from Dr. Crosse, the Company's principal medical officer.

Yours, &c.
(Signed) HENRY MORLEY,
Secretary.

W. T. Thiselton Dyer, Esq., C.M.G., F.R.S.

[Enclosure.]

Asaba, River Niger,
17th January 1891.

I REGRET to have to inform you that Mr. Woodruff died at Asaba on January 2nd, 1891, from blackwater fever, followed by inflammation of his kidneys.

I have to inform you that, before he died, Mr. Woodruff made a will, by which it is arranged that his property is to be sold and the proceeds, together with his balance of wages, divided equally between his sister and his fiancée. As soon as I conveniently can, this will be carried out.

Please let me know what amount stands to his credit in the London books, and should he have left an allotment, perhaps it will be as well to stop it.

His effects may realise about 15*l*.

(Signed) W. H. CROSSE.

EXTRACT from Dr. CROSSE's Diary.

Dec. 29th.—Mr. Woodruff, at his own earnest request, was removed to Asaba in a steamer. He is very ill, has constant vomiting, which pulls him down very much, has everything he can wish for (as champagne, brandy, soda, unsweetened, milk, &c.).

CXCVII.—ADEN BARILLA.

(*Suæda fruticosa*, L.)

In the *Kew Bulletin* for March 1890, an account is given of what is known as the Barilla industry. Reference is made to the production of this product at Aden, a subject upon which hitherto little has been known. The following correspondence gives the result of an application to the India Office to procure specimens of Aden Barilla, and of the plant producing it, for the Kew Museum.

INDIA OFFICE to ROYAL GARDENS, KEW.

India Office, Whitehall, S.W.,
24th February 1891.

SIR,

WITH reference to your letter of the 12th July last, I am directed by the Secretary of State for India, to forward you herewith a copy of a letter received from the Political Resident at Aden, and to inform you that the case therein referred to, containing a cake of manufactured Barilla and specimens of the plants from which it is made, has been forwarded to your address.

I am, &c.
(Signed) C. E. BERNARD,
Secretary,
Revenue and Statistics Department.

The Director,
Royal Gardens, Kew.

[Enclosure.]

COPY of LETTER from the POLITICAL RESIDENT, ADEN, dated 8th January 1891.

WITH reference to your Lordship's Despatch to the address of the Government of Bombay, No. 11 (Revenue), dated 30th October 1890, I have the honour to forward to your address a case containing a cake of the Barilla as prepared at Bir Ahmed (near Aden) where it is best made. It is broken in two pieces, but this is a proof of its good quality as the inferior cakes only remain whole.

A rough specimen of the material as prepared for burning is forwarded, and also some specimens of the green plant.

2. The mode of preparation is as follows:—The young green twigs at the ends of the branches are picked and left on the ground in the sun for seven days, at the end of which time they turn black, but are full of moisture. Shallow pans with a diameter of from 18″ to 2′ are then dug in the sand and the blackened twigs are put into them and then ignited, and allowed to burn for some hours, at the end of which time they become a viscous pulpy mass, which is gently stirred with a stick until

it cools, which it does in six hours, and on the following day the solid cake is removed. Should rain or water fall on the picked twigs they become useless.

3. The bush is now at its brightest and freshest. I have also enclosed some specimens of the flower as at present growing on most of the plants. They were picked on the 1st of January, and the specimens of the plant on the same day.

I have, &c.
(Signed) JOHN JOPP,
Brigadier-General, Political Resident.

ROYAL GARDENS, KEW, to INDIA OFFICE.

SIR, Royal Gardens, Kew, 30 March 1891.

I HAVE the honour to acknowledge the receipt of your letter [R. & S., 152] of February 24, enclosing a copy of a letter received from the Political Resident at Aden and informing me of the despatch to this establishment of various specimens illustrative of the Barilla industry.

2. These specimens have since arrived, and will form a valuable addition to the museum of this establishment.

3. The plant sent by Brigadier-General Jopp proves to be *Suæda fruticosa*, L., and not, as stated in Mr. George Watt's report, communicated in your letter of August 13, 1885 [R. S. & C., 969], *Suæda nudiflora*, the so-called "Aden Balsam."

4. The manufacture of Barilla has been the subject of inquiry at this establishment on the part of the Egyptian Government, and I purpose publishing the interesting information now obtained in the *Kew Bulletin*.

I am, &c.
(Signed) W. T. THISELTON DYER.
Sir Charles E. Bernard, K.C.S.I.

CXCVIII.—ASSAM RUBBER FOR WEST AFRICA.

(*Ficus elastica*, Bl.)

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 20 November 1890.

I AM directed by Lord Knutsford to transmit to you, for your information, a copy of a despatch from the Governor of Lagos on the subject of the *Ficus elastica* of Asia.

I am, &c.
(Signed) JOHN BRAMSTON.

The Director,
Royal Gardens, Kew.

[Enclosure.]

Sir ALFRED MOLONEY to LORD KNUTSFORD.

Government House, Lagos,
13 October 1890.

MY LORD,

I HAVE the honour to acknowledge the receipt, direct from India, of three packets of seed of the *Ficus elastica*, as also of an account by Mr. Gustav Mann, Conservator of Forests, of the mode of culture pursued in Assam.

2. For their ready and practical co-operation, may I invite your Lordship to convey to the Government of India the thanks of this Colony.

3. The information supplied is of such general interest and value I have ventured to issue it in extenso as a circular, of which I would ask your Lordship to allow the Director of the Royal Gardens, Kew, to have some copies.

4. The seed received has been treated in accordance with the method employed in Assam in the cultivation of this rubber tree. I trust the experiment will prove a success and justify the trouble I have given.

I have, &c.
(Signed) ALFRED MOLONEY.

The Right Hon.
Lord Knutsford, G.C.M.G.
&c. &c. &c.

CIRCULAR.

Colonial Secretary's Office, Lagos,
30th September 1890.

The following correspondence on the subject of the *Ficus elastica* of Asia has passed between his Excellency the Governor and the Right Honourable Secretary of State for the Colonies.

The *Ficus elastica* is distributed over Assam, Java, and probably other Malayan countries; it is cultivated in Malabar, and is the chief, if not the only, source of Assam and Java caoutchouc.

The caoutchouc supplied by this tree is only second in importance as an article of export to that of the celebrated *Hevea braziliensis* of the Amazon Valley.

The tree is of similar growth in almost every respect to the "Abba" tree (*Ficus Vogelii*) of Yoruba, and would doubtless thrive excellently in the moist climate of the West Coast of Africa.

The preparation of the caoutchouc is similar to that of the "rubber" of the *Landolphia owariensis* of West Africa. Such of the milk as flows freely is coagulated by boiling, but the greater part is allowed to dry on the tree, from which it is stripped when sufficiently evaporated to bear handling.

The value of good and fine Assam caoutchouc was quoted in 1887 at from 2*s.* to 2*s.* 7*d.* per pound, and in the quantity annually shipped to the United Kingdom it would appear to compare favourably with the Para Rubber.

The seed of this valuable tree, which has been supplied through the kind offices of the Indian Government, is now being cultivated at the Botanic Station of this Colony, and young plants will be available for the public in a short time. As little or no skill is required in its cultiva-it is to be hoped that it will soon establish itself in this Colony and the neighbouring States.

By Command:
ALVAN MILLSON,
Assistant Colonial Secretary,
pro Acting Colonial Secretary.

The UNDER SECRETARY OF STATE FOR THE COLONIES.

S.S. "Sherbro," at Sea,
SIR, 29th January 1890.

I HAVE the honour to request that the Secretary of State for the Colonies may be pleased to invite the co-operation of the Indian Government in the direction of the supply to the Botanic Centre of the Colony of Lagos of some seed of the *Ficus elastica,* also a copy of instructions on the mode of its culture pursued in Malabar.

I have, &c.
(Signed) ALFRED MOLONEY.

COLONIAL OFFICE to INDIA OFFICE.

SIR, Downing Street, 13th March 1890.

I AM directed by Lord Knutsford to transmit to you, to be laid before Viscount Cross, a copy of a letter from the Governor of Lagos on the subject of the "*Ficus elastica.*"

Lord Knutsford would be glad if the seed required by Sir Alfred Moloney, together with the information regarding the culture of this plant in Malabar, could be supplied through your Department.

Any expense which may be incurred will of conrse be defrayed from Lagos funds, and upon application to this Department the Crown Agents will be directed to pay the amount in such manner as the Secretary of State for India may desire.

I am, &c.
(Signed) ROBERT G. W. HERBERT.

The Under Secretary of State,
India Office.

INDIA OFFICE to COLONIAL OFFICE.

(R. & S. 354.) India Office, Whitehall, S.W.,
SIR, 24th April 1890.

I AM directed by the Secretary of State for India in Council to acknowledge the receipt of your letter of the 13th ultimo, enclosing a copy of a letter from Sir Alfred Moloney, and in reply to state that the Government of India have been requested to procure, if possible, 1 cwt. of the seed of *Ficus elastica,* and to forward the same to the Governor of Lagos together with the required information as to the culture of the plant.

I have, &c.
The Under Secretary of State, (Signed) A. GODLEY.
Colonial Office.

Local Form No. 1.

No. Kf. 134.

From GUSTAV MANN, Esq., Conservator of Forests, Assam, to his Excellency the GOVERNOR OF LAGOS.

SIR, Dated Shillong, the 24th July 1890.

IN obedience to the orders received from the Government of India, I have the honour to advise your Excellency of the despatch of three small bags of rubber seed (*Ficus elastica*), containing about one pound of seed, by sample post, and to enclose a brief account of the methods employed in cultivating this tree in Assam. I also enclose copy of a letter addressed to the Secretary to the Chief Commissioner of Assam, from which it will be seen that the seed is very small and light, so that probably a pound or two will be found sufficient instead of 1 cwt. as now ordered.

I have, &c.
(Signed) Gustav Mann,
Conservator of Forests, Assam.

Copy of Letter No. Af. 73, dated Shillong, the 21st July 1890, from the Conservator of Forests, Assam, to the Secretary to the Chief Commissioner of Assam.

I have the honour to acknowledge receipt of your office Memo. No. 201/72, dated the 27th ultimo, forwarding to me a copy of the Government of India letter No. 494, and dated the 18th June 1890, and directing me to send to his Excellency the Governor of Lagos, on the West Coast of Africa, 1 cwt. of seed of *Ficus elastica* for cultivation in that Colony.

2. With reference to these instructions, I beg to report that the seed of *Ficus elastica* ripens in February and March, and that I will make the arrangements, if necessary, to have it collected of good quality at that season, but before doing so, I beg to point out that this seed is extremely small and light, so probably a much smaller quantity will suffice to commence with, each of the figs contains about 75 seed, and as 90 figs go to one tolah it will make the number of seeds in one pound 270,000, which ought to be sufficient to begin experimenting with, even though there should be no skilled labour available for sowing it.

3. I have obtained about 1 lb. of seed from Kamrup, which I will send at once to his Excellency the Governor of Lagos by post, and I shall write direct advising the despatch of the seed, and giving a brief account of the methods employed in cultivating the Rubber tree here in Assam; the expenditure incurred is so trifling (six annas), that it is not worth while recovering; the postage on two letters would exceed it.

4. I shall await further instructions before despatching more seed.

Brief Account of how Rubber Trees (*Ficus elastica*) are grown in Assam.

The seed ripens from January to March, when it is collected as it falls off the trees, and afterwards dried in the sun.

It is, properly speaking, the fruit, and consists of small figs, the size of a pea. These at the time of sowing are broken between the hands, and the seed thus mixed with the particles of the fruit is sown without any attempt to clean or separate the seed.

2. Germination takes place sometimes only three months after the seed has been sown, and as it is very small it must be sown on the *surface* of the soil only, but otherwise just like the seed of any other plants, it requires as much light as possible from above; side shade is an advantage. The seed can be sown on beds, or in boxes or flower pots, but it is most essential that the drainage of the soil be perfect, and that the earth never becomes soaking wet, whilst on the other hand it

should neither be allowed to become thoroughly dry, but be kept always moist.

3. As the seedlings are very small at first they must be treated with great care, and drip from trees above the seed bed must be guarded against; the soil must be kept loose, and open vegetable mould is the best soil.

4. When the seedlings are 2–3 inches high they have formed already a little thickened root something like a small carrot, and can then be transplanted very safely; this should be done on to a properly dug nursery bed, *well drained*, and the seedlings should there be placed about one foot in lines also a foot from each other.

5. After the seedlings have become 1–2 feet in height they are very hardy, and can be transplanted at any time of the year, but as the deer are very much after the leaves of the rubber trees, and to avoid the great expense of fencing in our plantation we have of late years transplanted the young trees a second time in nurseries giving them more room, say, 3–4 feet square each plant, and let them grow until 10 to 12 feet high, when they can be put out into the plantation without fear that the deer will destroy them; they require, however, a strong stake each, as the deer will bend the young trees down with their horns, if not staked.

6. The seed of *Ficus elastica*, where the tree grows naturally in the forests, germinates almost invariably in the forks of trees, 30 to 40 feet and more above the surface of the ground, and the young trees grow in consequence for some 6 to 10 years as epiphytes, after which the aerial roots reach the ground, and increase rapidly in size, until some of them reach a girth of from 4 to 6 feet; they are very numerous, and it is not uncommon at a later age that they are thrown out also from the upper branches 60 to 80 feet from the ground, being first as thin as whipcords, but very soon increasing in size after they have reached the ground; it thus frequently happens that the tree on which the young rubber seedling first germinated, is killed by the more vigorous growing *Ficus elastica*, which in this respect resembles the well known Banyan tree, and is one of the largest growing members of our mixed forest in Assam. It requires an exceedingly damp atmosphere to do well, and therefore thrives best at the foot of the mountains, or on the mountains themselves up to an elevation of 2,000 feet. It is met with also at a higher elevation, but not so vigorous, and at 5,000 feet it is liable to be injured or killed by frost.

7. Seedlings of *Ficus elastica* planted in the forks of trees in the forest are very difficult to attend to, and they in consequence often become dry about their roots, which retards their growth if it does not kill them; for these reasons the rubber trees planted on the ground have grown much better in the Assam plantations, and the latter mode of planting has therefore been adopted almost exclusively; they are not planted, however, on the ground in the common way but on small mounds, 3 to 4 feet high, of earth, and the cut-wood and rubbish close at hand, which suits the epiphytal habit of growth of this tree.

8. These rubber trees can also readily be propagated from cuttings if only perfectly ripe young branches or shoots are used; but young trees so raised never are so hardy as the seedlings, and do not make equally good growth afterwards.

9. To ensure the greatest possible amount of moisture in the atmosphere, the plantations of *Ficus elastica* have been made in the moist evergreen forest near the foot of the hills, through which lines 40 feet in width were cleared 100 feet apart from centre to centre of the lines,

thus having 60 feet of forest standing between the lines; on these cleared lines the mounds for the planting of the seedlings or saplings are thrown up at distances of 25 feet apart, care has to be taken afterwards to prevent the forest trees left standing closing in above, over the lines, and the rubber trees planted on them, which they have always a tendency to do, and which, if not guarded against, is very detrimental to the growth of the young rubber trees. The undergrowth, which springs up on these lines and grows most vigorously has also to be cleared two or three times in the year for the first four or five years to admit air for the young rubber trees, but beyond this, and the putting occasionally some more earth into the mounds, nothing is necessary.

10. The lines on which the rubber trees are planted are cut in an east and west direction, so as to protect the young rubber trees against the strong sun in the middle of the day; the atmosphere also keeps moister in this case than if the lines were cut south and north.

11. High ground is always best, and swampy ground where water lodges should be avoided, but the tree grows very well on alluvial flats on the banks of rivers, even though this be inundated for a few days once or twice in the year.

GUSTAV MANN,
Conservator of Forests, Assam.

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

Nos. 53–54.] **MAY and JUNE.** [1891.

CXCIX.—BOTANICAL ENTERPRISE IN THE WEST INDIES, 1890–91.

The scope of botanical effort in the West Indies has of late years been considerably expanded. This has been due to a desire on the part of the smaller islands to possess botanical institutions that would be capable of becoming centres for the growth and distribution of economic plants, and thus assist in the general development of local industries. The larger establishments at Jamaica, Trinidad, and British Guiana have already proved of great value in this direction. To meet the wishes of the smaller islands a scheme of Botanical Stations has been devised as described in the *Kew Bulletin* (June and July 1887). In the organisation of this scheme successive Secretaries of State for the Colonies have taken a warm interest, while in the elaboration of the details Kew has taken an active part.

Since 1884 Botanical Stations have been established in the Windward Islands at Grenada, St. Vincent, and St. Lucia; in the Leeward Islands at Antigua, Montserrat, Dominica, and St. Kitts-Nevis; while

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
88 and 90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Fourpence.

a very important one has been in active work for some time at Barbados. The Curators at these Stations are, for the most part, men carefully trained at Kew, and their chief qualification is a thorough knowledge of horticultural methods as applied to tropical plants. The main object in view is to meet the special circumstances of the West Indies at the present time, and do all that is possible to encourage a diversified system of cultural industries, and thus relieve them from the results inevitable from the fluctuations of prices in the one or two staples to which they have hitherto confined their attention. The Botanical Station scheme affords indirectly the basis of a federation for purely economic purposes likely to be beneficial to all classes of the community.

As the scheme took root the discussion of details involved a heavy burden of correspondence on Kew, and unexpected administrative difficulties arose which required careful and judicious treatment. The task seemed almost hopeless of solving the difficulties successfully by correspondence alone. It therefore seemed advisable to send out to the West Indies a member of the Kew Staff, who by previous experience was well acquainted with the different Colonies, and who by oral discussion would be able to remove many of the obstacles in the way of the progress of the scheme. The task was entrusted to Mr. D. Morris, F.L.S., the Assistant Director, who before his transfer to Kew had been for many years in charge of the Botanical Department at Jamaica. The following correspondence records the circumstances under which the Imperial Government assented to Mr. Morris's mission. He left England in November last, and returned to Kew at the end of February. His detailed report on the present position of the Botanical Stations is, by permission of the Secretary of State, reproduced in the present numbers of the *Kew Bulletin*.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, 21 March 1890.

I HAVE the honour to acknowledge the receipt of your letter of March 15, in which you inform me of the general concurrence of the Secretary of State in the views which I have ventured to express as to the measures which it appears to me desirable to take for the development of the resources of the West India Islands, by what may be conveniently described as "botanical enterprise."

A good deal, as you are aware, has been already accomplished in the way of the needful organisation. But though no pains have been spared by this establishment to get matters into a right groove by means of unofficial correspondence, I cannot say that I am altogether satisfied with the position in which they at present stand. I am driven, therefore, to the conclusion that the new system will only obtain the start which is necessary for its subsequent progress on a permanent basis, if it receives, in its present stage, the assistance and supervision of an officer thoroughly conversant with the technical details of an administrative problem of this description, and well acquainted with the successive steps which, during the past eight years, have been taken in its development.

It is for these reasons that I have suggested that the Assistant Director should go out to the West Indies next winter. I must confess that I am reluctant to deprive myself of the services of the principal member of my staff; but I feel that the situation is of sufficient importance to demand some sacrifice on my part.

On the other hand, Mr. Morris, while equally impressed with the importance, and, indeed, necessity of the mission, and willing to undertake it, is in no degree anxious to do so. While he is ready to go as part of his official duties, and therefore does not suggest that any honorarium additional to his pay should be given him for his services, he very properly stipulates that his mission shall not in any way be held to affect his salary, service, or other circumstances of his position as a member of the staff of this establishment.

A mission of this kind must be regarded as an affair of State. It must, therefore, be distinctly understood that the only official action I can take beyond advising it, is to give it my formal sanction. The necessary assent of Her Majesty's Government must be obtained by the Secretary of State, and it must filter down to me through the regular official channels.

I am, &c.
(Signed) W. T. THISELTON DYER.

Edward Wingfield, Esq., C.B.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 26th April 1890.

I AM directed by Lord Knutsford to acquaint you that, with the concurrence of the Lords Commissioners of the Treasury, His Lordship desires to avail himself of the services of Mr. Morris in visiting, in the course of this year, the following West Indian Islands: Grenada, St. Vincent, St. Lucia, Antigua, St. Kitts, Dominica, in which Botanical Stations have been or are intended to be established, for the purpose of assisting the Colonial Governments in placing these institutions on a sound and durable basis.

Lord Knutsford understands from previous correspondence, that Mr. Morris is willing to undertake such a mission without any honorarium in addition to his salary, his expenses, of course, being defrayed by the Colonies in question, and that you are willing that he should do so.

I am to request to be informed at what time it would be convenient for Mr. Morris to visit the islands.

I am, &c.
(Signed) ROBERT G. W. HERBERT.

The Director,
Royal Gardens, Kew.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, 2 June 1890.

I HAVE the honour to acknowledge the receipt of your letter of April 26, in which you request to be informed at what time it is proposed that Mr. Morris should leave England in order to visit the West Indian Islands in which Botanical Stations have been or are intended to be established.

In reply I have to inform you that the middle or beginning of November would be the most convenient date to fix.

It has always been part of the scheme that the stations should be in some kind of relation to the larger and central Botanical Departments of Trinidad and Jamaica. It will therefore be essential that Mr. Morris should also visit both those islands in order to settle the practical details of such an arrangement by conference with the respective heads of the two Botanical Departments. I am in hopes that by this last means Mr. Morris will see his way to solve finally the innumerable petty administrative difficulties which have hitherto hindered the effective working of the scheme and have given rise to so much correspondence.

I am, &c.
(Signed) W. T. THISELTON DYER.

Sir Robert G. W. Herbert, K.C.B.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

Royal Gardens, Kew, 22nd September 1890.

I HAVE the honour to acknowledge the receipt of your lettters of the 2nd and 14th ultimo, informing me that the Governments of the Windward and Leeward Islands will gladly avail themselves of Mr. Morris's services in his mission to the West Indies with the view to the development of the scheme for the establishment of Botanical Stations.

2. I am now in a position to inform you that Mr. Morris will embark by the Royal Mail Steamer leaving Southampton on the 12th November next, and in accordance with an intimation already privately conveyed to Sir W. F. Haynes Smith he will proceed direct to Antigua, where he hopes to arrive on the 27th November.

3. After consultation with the Governor-in-Chief he will visit severally the islands of the Leeward group, in which Botanical Stations have been or are intended to be established.

4. Mr. Morris will then arrange to proceed to the Windward Islands, and he will be prepared to meet Sir Walter Hely-Hutchinson at any island where he may at the time be engaged. Afterwards Mr. Morris will visit Trinidad and Jamaica to discuss and arrange any details that may be deemed necessary for the supervision of the stations from these centres, as suggested in the third paragraph of my letter of the 2nd June last.

* * * * * *

6. The Secretary of State will be interested to learn that Mr. Morris will take out with him from Kew, for the botanical establishments in the West Indies, several Wardian cases of Gambier plants (*Uncaria Gambier*) which have been raised for the purpose at this establishment.

7. Gambier is an article largely used for tanning purposes. It used to cost 10*l.* per ton, and now costs 40*l.* Hitherto it has been exclusively produced in the Straits Settlements, but the present state of the trade appears to justify its extended culture in other parts of the tropics. An effort is now being made, in accordance with the usual policy of Kew in regard to new cultures, to introduce the Gambier to the West Indies, where hitherto it has not been known.

8. The plants which Mr. Morris will take out with him will, it is hoped, enable the botanical establishments in this part of the world to raise within a reasonable time a stock sufficiently large to distribute to such planters as may feel disposed to try it on a commercial scale.

A somewhat full account of Gambier is given in the *Kew Bulletin* for 1887, pp. 247-253, a copy of which is enclosed.

9. You will easily understand that the delegation of a member of the staff of an administrative establishment such as Kew upon a mission of this kind is a procedure of an extremely exceptional nature. It has only been justified by a sense of the extreme importance at the present moment of starting the West Indies in a direction which there is good ground for believing will lead to their ultimate prosperity. This the West Indies are beginning themselves to understand. There are already indications that there will be every desire to use Mr. Morris's assistance to the utmost. There will be every inducement, in all probability, brought to bear upon him to prolong his stay, so as to give his technical assistance in many matters outside the immediate scope of his mission.

I feel it, however, my duty to point out that I have obtained the assent of my Board for his absence during a period specially limited to three months, and I do not think that it would be compatible with the due performance of the multifarious and absorbing duties which fall on this establishment to entertain any proposal for a prolongation of this period.

I have, &c.
(Signed) W. T. THISELTON DYER.

Edward Wingfield, Esq., C.B.,
Colonial Office, S.W.

The following letters, communicated to this establishment by the Colonial Office, express the satisfaction of the Governments of the Leeward and Windward Islands respectively at the manner in which Mr. Morris carried out his mission.

The GOVERNOR OF THE LEEWARD ISLANDS to the COLONIAL OFFICE.

Government House, Antigua,
December 27, 1890.

MY LORD,

I HAVE the honour to report that Mr. D. Morris, the Assistant Director of the Royal Gardens at Kew, arrived in the Colony, and in company with myself has visited each of the different islands.

Much interest has been exhibited in the objects of Mr. Morris's visit, and an impetus has been given, by his energy and ability, to the development of cultural industries, for which I desire to express to your Lordship my warm acknowledgments.

Mr. Morris has now seen for himself, and, I believe is convinced, that there is a much larger field for enterprise in the Leeward group than is generally supposed. I have already, in this connexion, expressed to your Lordship my own opinion, that these islands may become whatever your Lordship chooses, and the present appears to be a favourable opportunity for taking active measures.

* * * *

Public meetings were held in Antigua, St. Kitts, Dominica, and Montserrat, which were well attended, and at all of which much interest was shown, with the evident desire of obtaining instruction.

The Gambier plants have thriven in Dominica with great success, and I propose to open a Government plantation for the cultivation of Gambier, for, if attention in England can be directed to the very exceptional advantages offered in Dominica for the cultivation of various economic tropical plants, the Crown lands there would be readily taken by persons with capital.

The visit of Mr. Morris has been very well received by all classes, and it has been taken as a pleasant gift from the Home authorities.

If your Lordship sees no objection, I would ask that the thanks of the Colonial Government might be communicated to the authorities at Kew, for permitting Mr. Morris to visit these islands, and to Mr. Morris personally, for the valuable services he has rendered to the Colony during his visit, services which I trust he may add to by continuing to give us his aid whenever it may be possible for him to do so.

I have, &c.
(Signed) W. F. HAYNES SMITH.

The Right Hon.
Lord Knutsford, G.C.M.G., &c.

The GOVERNOR-IN-CHIEF OF THE WINDWARD ISLANDS to the COLONIAL OFFICE.

MY LORD, St. Vincent, January 19, 1891.

WITH reference to your Lordship's despatch, Grenada, No. 79, of 30th September, I forward reports by Mr. D. Morris on the Botanic Gardens of St. Lucia, St. Vincent, and Grenada.

I am in communication with the Administrators of St. Vincent and St. Lucia, and shall do my best to give effect to Mr. Morris's suggestions.

* * * * * *

Mr. Morris arrived in Grenada on the 1st instant, and left on the 16th instant. I regret to say that for three days he was unable to leave the house, having injured his foot by an accident at St. Vincent. This delayed his work in Grenada, and rendered it impossible for him to complete it in time to enable him to visit Trinidad.

Mr. Morris visited some of the principal estates in Grenada, and delivered an interesting and instructive address in St. George's. He devoted several days to a thorough examination of the Botanic Garden, and spent two days in a botanical exploration of the ridges above the Grand Étang.

* * * * * *

I beg reference to the Administrator's despatches, forwarding an account of Mr. Morris's proceedings at St. Lucia and St. Vincent.

Mr. Morris has been at great pains to inform himself as to the agricultural requirements of the islands. He has devoted himself with remarkable zeal and energy to the objects of his mission, has shown a deep interest in the progress of these communities, and has made many valuable suggestions to those interested in horticulture and agriculture. The advice which he has given, and the suggestions he has made, should not fail, if followed out, to conduce to valuable results. I give expression to a widely felt sentiment when I say that these Colonies are deeply indebted to Mr. Morris for his exertions, and to Her Majesty's Government for allowing him to visit the Windward Islands.

I have, &c.
(Signed) WALTER HELY-HUTCHINSON.

The Right Hon.
Lord Knutsford, G.C.M.G., &c.

REPORT of a BOTANICAL MISSION to the West Indies, undertaken by the Assistant-Director, Royal Gardens, Kew, presented to the Secretary of State for the Colonies, April 20, 1891.

IN accordance with the arrangements made at the request of the Secretary of State for the Colonies, and with the consent of the Lords Commissioners of Her Majesty's Treasury, and of the First Commissioner of Her Majesty's Works and Public Buildings, I left Kew for the West Indies on the 12th November 1890. I embarked at Southampton in the Royal Mail steamship "Atrato." I took out with me from the Royal Gardens, Kew, six Wardian cases of Gambier plants and four boxes of vine cuttings. These were destined for the following botanical institutions in the West Indies: A Wardian case of Gambier plants each for the Botanical Gardens at Trinidad and British Guiana; a Wardian case of Gambier plants and a box of vine cuttings for the Botanical Station at St. Vincent; a box of vine cuttings for the Botanical Station at St. Lucia; a Wardian case of Gambier plants and a box of vine cuttings for the Botanical Station at Dominica; and a box of vine cuttings for the Botanical Garden at Grenada. The Gambier plants had been raised at Kew from seed received from the Botanical Department of the Straits Settlements. They had always proved most difficult to send in Wardian cases, and several attempts to obtain plants from the East had hitherto failed. A full account of Gambier, a tanning substance obtained from *Uncaria Gambier*, Roxb., is given in the *Kew Bulletin*, October 1889, p. 247.

The present attempt to introduce the cultivation of Gambier into the West Indies is a fact of some interest. It was only possible to arrive thus far in the matter after several years of persistent effort. The Gambier industry had hitherto been entirely confined to the East Indies, but owing to the increased demand due to American consumption and the deterioration in quality which had obtained of late years it was felt desirable to extend its culture to other parts of the tropics. The effort made to place these plants at the disposal of those who may be inclined to cultivate them in the West India Islands is only a part of the policy pursued at Kew for many years. The plants in the first instance were entrusted to the botanical establishments in the West Indies to be propagated and distributed.

Owing to the cold weather the cases on board the "Atrato" were placed below in the main saloon. There was very little direct light in the day-time, but the question of warmth was for the moment of more importance than that of light. It was also hoped that they could be placed on deck in a day or two at the most. The weather during the whole of the first week, however, continued very cold, and it was impossible to expose the plants on deck. Under these circumstances it was fortunate that the electric light, with which every part of the ship was supplied, was available to try an experiment of some interest. Although the plants received very little light during the day, they had a good supply of the electric light during the night, and the plants in the cases more fully exposed to the electric light were afterwards found to be in a much better condition than the others. It is well known that plants will thrive under the influence of artificial light, but in this instance there was so little direct light available during the day that the plants had to depend almost entirely on the light they received at night. The Gambier plants are particularly sensitive as regards a diminution of light. During the prevalence of fogs at Kew they have been known to drop their leaves within a day or two, and to remain bare during the rest of the winter. This may have been in some measure also due to the injurious influence of the fog itself.

In the present instance the plants were placed below on the 12th November, and were removed on deck on the 19th November. They had been below exactly one week. On deck they were placed on a hatchway on the starboard side, and shaded from the direct rays of the sun by an awning.

In order to make myself acquainted with the exact condition of the plants before they left my charge, the cases were opened on the 22nd November, about 36 hours before arriving at Barbados. All the plants were in good order; a few, it is true, had lost their leaves, but the greater number were in excellent condition. The case in which the plants had suffered most was one of the two intended for the Jamaica Gardens. This had been placed with its end towards the electric light, and, in consequence, had received less direct light than the others.

The use of electric light for the safe transit of such valuable plants as are obliged to be despatched from this country during the winter months is evidently capable of being greatly extended. It may also be utilised in the case of tropical plants arriving in this country from abroad, during the prevalence of cold weather. Such plants could be placed below directly the weather is becoming too cold for them on deck, and then the more electric light they have the better.

The "Atrato" arrived at Barbados on the morning of the 24th November. The cases for St. Vincent and Trinidad were transhipped on board the "Eden"; the case for Demerara was transhipped to the "Esk"; the case for Dominica was transhipped to the "Solent"; while the cases for Jamaica remained on the "Atrato," to go on direct to Kingston. The cases that were transhipped were carefully handled under the supervision of Mr. Owen, the chief officer of the "Atrato," and my personal thanks are due to Captain Brander and to this officer for the great interest they took in this valuable consignment of plants, and for the facilities afforded for their careful treatment during the voyage.

The reports received respecting the Gambier plants on arriving at their destination were as follows:—*Jamaica, Dec. 1st*, "34 plants in "good order, 8 in fair order, 38 somewhat weak"; *British Guiana, Dec. 3rd*, "the plants arrived safely, all living"; *Trinidad, Dec. 17th*, "all the plants arrived safely, the larger portion growing freely"; *St. Vincent, Dec. 19th*, "15 plants in good order, 7 leafless, 10 dead"—these plants were overcarried by the "Esk" to Trinidad and La Guayra, and returned to St. Vincent 10 days late; *Dominica, Nov. 28th*, "the plants arrived in good condition."

As it had been arranged that I should first proceed to the Leeward Islands, I left Barbados on the evening of the 24th November, in the "Solent." The next morning we touched at Castries, the chief port of St. Lucia, and I had an opportunity of going ashore for about two hours, and visiting the Botanical Station with Mr. John Gray, the Curator. The steamer left Castries about 9 o'clock. The voyage from St. Lucia to Dominica was rendered particularly interesting on account of the clearness of the atmosphere and the beautiful view obtained of the chain of islands. Probably in no part of the world would it be possible to see a more charming picture of tropical scenery. After calling at St. Pierre, in Martinique, we arrived off Roseau, in Dominica, about 5 o'clock in the afternoon. The President of Dominica, Mr. G. R. Le Hunte, and Dr. H. A. A. Nicholls came on board to meet me. I was gratified to learn that Mr. Green, the curator lately appointed to the Dominica Botanical Station, had made an excellent impression. Mr. Le Hunte brought with him a choice collection of cut flowers from his garden and some excellent fruit, as evidence of what could be grown in the climate and soil of Dominica. The case of Gambier plants and the box of vine cuttings were safely landed for the Dominica Botanical Station. The steamer touched at Basseterre, Guadeloupe, at midnight, and at Plymouth, Montserrat, in the very early morning. Soon after clearing Montserrat we had Redonda, a rocky islet, immediately to the north-west, and the peaks of Nevis and St. Kitts in the clouds beyond. To the north-east, about 25 miles away, was Antigua, with its low conical hills in the neighbourhood of Five Islands. We arrived outside the harbour of St. John, Antigua, about 10.30 on the morning of the 26th November. I was met by Mr. Lucie Smith, the Governor's private secretary, and reached Government House soon after 11 o'clock. I was kindly received by his Excellency Sir William F. Haynes Smith, K.C.M.G., and we proceeded at once to discuss the best means for carrying out the objects of my visit.

LEEWARD ISLANDS.

ANTIGUA.

Antigua is the seat of the Federal Government of the Leeward Islands, where the Governor and principal officers of the Colony reside. The Presidency of Antigua includes the islands of Barbuda and Redonda, with a total area of 170 square miles. Antigua is comparatively flat, the chief hills, reaching 1,200 to 2,000 feet, occupying the south-western portion. The climate is considered very healthy. It is generally dry, and sometimes suffers from severe droughts. The soil, composed of stiff clays and calcareous marls, is very retentive of moisture, and produces large crops. The chief productions are sugar, molasses, and rum. Some pine-apples and fruits are grown for export, and the negroes plant yams, sweet potatoes, guinea corn, and bananas. About one-third only of the island is under cultivation at the present time. The chief town is St. John, situated on a gentle slope overlooking a harbour of the same name. The population of St. John is about 10,000; of the whole island about 35,000.

November 26.—My first visit in Antigua was paid to the land selected as a site for the Botanical Station on Clare Hall Estate. Although operations had only been commenced during the past 12 months, considerable progress had already been made in laying out the land, and in starting nursery beds and experimental plots. The latter were devoted to 20 varieties of grape-vines, pine-apples, fibre plants (*Sansevieria*, *Boehmeria*, *Furcræa*), bananas, cacao, Egyptian cotton, coffee, mulberry for silkworms and fruit trees. The nursery beds contained several hundred small plants ready for distribution, and some ornamental trees and shrubs suitable for shade and shelter.

A short distance from the Botanical Station (on the Skerrits Estate) it is proposed to establish a reformatory school for boys. The labour of these boys is to be chiefly devoted to the growing of provisions and food plants for their own maintenance, and to carrying on experiments in regard to sugar-cane cultivation, on the lines so successfully pursued at Dodd's reformatory, Barbados. This will give a valuable industrial training to about 300 or 400 boys, and the experimental cultivation carried on by them will prove of great advantage to the Colony. A portion of the same estate, immediately at the back of the town of St. John, is in course of being laid out as a public park. Driving roads were being made through it, and the grass land was being levelled and planted with shade and ornamental trees.

November 27.—After an early visit to the Botanical Station I accompanied the Governor to Wallens, a district in the heart of the hills of the south-west, where a large reservoir is in course of being built to supply the island with water. Antigua has always suffered from want of a continuous supply of water. There are few or no streams, and the only water usually available is supplied from ponds. I was able to offer some recommendations in regard to maintaining the slopes above the reservoir in low grass, and in protecting the ridges of the hills and the declivities where the water collects with shrubs and trees. We afterwards drove to Old Road (near Carlisle Bay), and back to St. John along the coast road to Johnson's Point and Blubber's Valley.

The principal plants noted on this journey were fine specimens of Walnut (*Andira inermis*), the African oil-palm (*Elaeis guineensis*), and large numbers of mahogany (*Swietenia Mahagoni*). The latter were badly injured by boring beetles. Plants of the Mocho palm (*Cocos amara*), evidently introduced, were seen near the town reservoirs.

November 28.—I discussed with the Curator, the plan of operations at the Botanical Station, and drew up a form of weekly report to be forwarded to the Colonial Secretary's office. At the request of the Governor, I gave an address in the Court House, St. John, at 3 o'clock, on Cultural industries suited to the circumstances of Antigua. The Governor took the chair. To quote from the *Antigua Observer*, "There were present the Colonial Secretary, the Chief Justice, Bishop "Branch, the Members of the Legislative Council, and most of the "leading proprietors and planters." Attention was drawn to the improvement capable of being effected in regard to the sugar industry by the introduction of new canes, and by attention, with the aid of the agricultural chemist lately appointed, to scientific discoveries in regard to a proper system for manuring cane fields, and to an effective and economical treatment of the cane juice. Information was also given on the subject of fibre plants, Egyptian cotton, the cultivation of fruits, coffee, cacao, tobacco, and fodder grasses. At the close of the address resolutions were passed in favour of establishing an agricultural and commercial society for the Colony of the Leeward Islands. This society was proposed to devote special attention to the development of local industries, and to advise the Government in any matters calculated to increase the productive resources of the islands by skilful and systematic cultivation.

After the lecture a visit was paid to the Pope's Head district to the north-west of the town of St. John. This is an undulating tract of country, with a rich retentive soil, where the canes, in spite of the drought, were in very good order.

November 29.—In order to give me an opportunity of seeing the eastern and southern portions of the island, the Governor kindly arranged to drive from St. John to English Harbour, through a district in which there were numerous sugar estates, and where some drainage works were in course of being carried on to relieve certain low-lying lands of water. In this district it is proposed to establish a large sugar factory or *usine*, with a light railway to bring in the canes from the surrounding estates. The route taken was, first of all, in the direction of Parham, and then in a southerly direction through Liberta village to Falmouth. At Liberta village the land is occupied by small settlers, who cultivate fruit trees and pine-apples. The pine-apples grow very freely on hill-slopes in a black friable loam apparently peculiar to this part of the island. This district produces nearly all the Black Antigua pines exported from the island. The industry is evidently capable of being largely extended. Steps are about to be taken to start a canning factory in order to utilise any fruit that may ripen in the intervals between the mails. The capabilities of raising fruit such as oranges, pine-apples, and bananas in this part of the island are evidently very great.

English Harbour is a naval station maintained by the Home Government for the ships of war on this station. Near it is a large tract of land, about 2,000 acres, belonging to the Government known as Piccadilly. This land is composed of rocky and stony ridges with some glades and valleys. It is in a very dry district, and is liable to severe drought at times. A good deal of scrubby bush is found upon it, and large quantities of the Keratto (*Agave Keratto*) and the Turk's-head Cactus (*Melocactus communis*). On the slopes of some of the hills, where the soil is good, pine-apples might be grown. Fibre plants would thrive on the more stony soils, and possibly cotton in the glades and valleys. If sufficient water were available to provide against seasons of drought, an excellent stock farm might be established here. On the top of the ridge, to the south of this land, and almost overlooking the naval station, there are solidly built, but now deserted, barracks still in a fair state of preservation. Although the district is very thinly populated, and there is no town of importance nearer than St. John, 12 miles away, troops were quartered here up to quite recent times. The naval station of English Harbour is still kept up, and occasionally a man-of-war or a gunboat puts in to clean and refit. When there is no vessel in the harbour the place has a singularly deserted appearance. Clarence House (once occupied by King William IV. when commanding on this station) overlooks the harbour, and is occupied by the commander of the war-ship that happens to be in the harbour. After dining with Captain Rayner, of H.M.S. "Tourmaline," we returned to St. John and arrived there about 11 p.m.

December 1.—Another morning visit was paid to the Botanical Station for the purpose of examining the land in the neighbourhood extending to the southward slope of Cedar Valley Hill. Some experimental cultivation is being attempted here by the Curator, in order to test the suitability of the locality for growing pines and certain kinds of fibre plants. The soil is of rocky character, and, as it has a southern aspect, is probably very hot and dry. The northern slope of the hill is too steep for cultivation, but at the foot there is a large extent of flat land suitable for grazing purposes.

In the afternoon the Governor drove out with me to Parham, a small town on the windward or eastern side of the island. Here two very interesting private gardens, belonging to Dr. Freeland, and his son Dr. F. J. Freeland, were visited. Dr. Freeland had numerous ornamental plants, such as Crotons, Araucarias, Roses, Orchids, and Aroids; while his son devoted his leisure time to the cultivation of ferns and small palms. These were chiefly in pots and sheltered by an arbour formed of pitch pine covered with creepers. In the village street were some interesting fan-leaved palms, probably *Sabal Blackburniana.*

December 2.—After meeting several planters, who desired information, at the Government offices, I visited a few private gardens in the town of St. John. Mr. Alleyne Archer, an enthusiastic horticulturist, had a very interesting collection of fruit trees and ornamental plants. Amongst the latter were fine plants of *Ipomœa Horsfulliæ*, a large flowered form of *Antigonon leptopus*, numerous plants in pots of the graceful *Thrinax radiata*, which is said to form large thickets in the island of Barbuda, and a very interesting series of *Hibiscus* hybrids. Dr. Edwards had a fine plant in flower of *Porana volubilis*, known locally as the " white corallina," a good plant of *Calliandra purpurea*, originally from Kew, and a grape-vine, Muscat of Alexandria. Bishop Branch, whose diocese extends over 16 islands, 10 English and six foreign, very courteously and kindly took me over his garden. It contains many interesting plants, and, where supplied with water, they are growing luxuriantly and producing a wealth of beautiful flowers. *Methonica* (*Gloriosa*) *superba* had established itself thoroughly in this remote part of the world, as also a fine form of *Bougainvillea glabra*, which clambered over high trees.

December 3.—The morning was devoted to a final visit to the Botanical Station. The details of work for the next twelve months were fully discussed, and arrangements made for planting shade and shelter trees on the eastern boundary.

The following contains a short description of the station and of the suggestions made to the Government respecting it :—

The Antigua Botanical Station is situated at Clare Hall (an old sugar estate, late the property of Mr. Liggins), about 1¼ miles from Government House, and 1¾ from the landing wharf at St. John's.

The site possesses good soil. It is somewhat exposed to the eastward, and will require to be sheltered by growth of mango or other hardy trees. There are three ponds of fresh water on the land; but it will no doubt be necessary to lay pipes on the upper portions to supply the nurseries and propagating sheds.

A house for the Curator is required to be built on the land. At present he lives in town, and is cut off from the immediate supervision of his work.

The arrangement of the plots is shown on a detailed plan left with the Curator. The plants under experimental trial are those which now attract chief attention at Antigua. Plot A will eventually be planted with bananas, and under the shade of these there will be established cacao, nutmeg, cloves, cola, fruit trees and other subjects likely to be successful at Antigua. Plot B, now growing the two varieties of Egyptian cotton, will be permanently established with economic plants of various sorts, grown as models of what such plants should be under proper treatment.

Plot C, on the slope of a rise facing south, is occupied with grapevines and pine-apples (Black Antigua). Grape-vines do fairly well in Antigua. A fruit industry is sought to be started in grapes for the markets of the United States and Canada. Pine-apples have not hitherto thriven in the northern parts of Antigua. They flourish best in the black soils at Liberta and other places to the extreme south of the island.

The nurseries and propagating sheds at Clare Hall are being gradually established. So far, seeds and plants of economic value are obtained with difficulty, but it is hoped arrangements will be made to secure supplies from Dominica, Jamaica, or Trinidad.

A plot about ½ acre in extent is opened on Cedar Valley Hill, about ¼ mile distant from the Botanical Station, in a northerly direction. It contains ¼ acre of *Furcræa cubensis* and pine-apples; and another ¼ acre of *Sansevieria lanuginosa* devoted to the experimental growth of this plant on a stony calcareous soil.

The Government possesses an extensive tract of country at Piccadilly, near English Harbour. The land is somewhat poor and arid, but it may be utilised for growing fibres and pine-apples, and other parts might be devoted to pen-keeping for cattle, sheep, horses, mules, &c.

The Curator of the Botanical Station, acting under the orders of the Government, has started a small experimental plot with pine-apples and fibres at Piccadilly. An effort will also be made to try cotton there. The arrangement of the present plot is shown on a plan marked D., with the Curator.

My visit to Antigua terminated this evening (December 3). After dinner I accompanied the Governor on board the "Solent" to proceed to Dominica. We touched at Montserrat at 2 a.m., and Guadeloupe at 8 a.m. We arrived abreast of Dominica about 11 a.m., and steamed comparatively close to the shore. The character of the slopes on the leeward side was well seen. Valley after valley opened out reaching far into the interior of the mountains. Thanks to the information kindly given by the Governor it was possible to form a very good idea of the large extent of forest land at Dominica capable of being established with remunerative cultures. The scenery in most of these islands is picturesque, but one is never tired of admiring the loveliness of Dominica.

DOMINICA.

Dominica is the largest and most southerly of the Leeward group. It contains 291 square miles, and has a population of about 29,500. The principal town is Roseau, on the south-west coast. The surface is very mountainous and abundantly clothed with vegetation, and in almost every valley there is a clear running stream of water. The climate is generally cool and pleasant. The rate of mortality is 15·6 per 1,000. The rainfall is abundant and regular. All the high elevations are covered with virgin forests, and only about 20,000 acres out of a total of 186,436 acres are now under cultivation. In fact, this beautiful and fertile island is quite undeveloped. Its industries are purely agricultural, and sugar-cane, cacao, limes, coffee, tropical fruit, and vegetables receive attention. The resources of the island are shown by the export, although at present in small quantities, of ginger, cinnamon, cloves, nutmegs, arrowroot, tous-les-mois, (Canna arrowroot). cassava, logwood, hard woods of various kinds, satin and cabinet woods, canoe-shells, &c.

We landed at Roseau, Dominica, about 2.30 p.m. We were met by Mr. Le Hunte, the President, and walked to Government House, which stands on rising ground to the south of the landing-place. A visit was soon after paid to the nurseries, established on land adjoining Government House pending the acquisition of the land selected for the

Botanical Station. Mr. Green, the Curator, had made excellent progress in raising plants, and the nurseries were in good order. The Gambier plants, landed 10 days previously, had already pushed forth new leaves, and were evidently doing well. Later in the day we drove up some distance into Roseau Valley, to see a new bridge in course of being built, and afterwards took a general view of the land proposed to be acquired for a Botanical Station.

December 5.—Mr. Blanc, Surveyor of Crown Lands, met me by appointment, on the land selected for a Botanical Station at 7 a.m., and the nature, boundaries, and extent of it were carefully examined. In the afternoon a ride was taken along the Windward Road in the direction of St. Joseph. This road is being placed in an excellent state of repair; culverts and bridges are being built. By means of this road a large extent of country will eventually become accessible for wheel traffic.

December 6.—The most interesting and possibly the most valuable portion of Dominica just now, is that stretching in a north-easterly direction from the mouth of the Layou river, on the west coast, to Ance Pagona or Commissioners Bay, on the east or windward coast. It comprises two extensive river valleys with elevations of 500 to 1,000 feet. Portions of these known as the Layou and Sara flats comprise together an area of about 20,000 acres, covered with valuable timber, and watered by a great number of streams joining the Mahaub and Layou rivers on the west, and the Quanary and Pagona rivers on the east side of the island. I was very anxious to see this portion of Dominica, and the Governor kindly arranged for a short visit to-day. The party consisted of the Governor, the President, Mr. Fadelle, the Colonial Engineer, and myself. We left Roseau in the Treasury boat at 7 a.m., and arrived off the mouth of the Layou river about 8.45. We were met here by Mr. Riviere, a leading sugar and cacao planter. After breakfast we started to ride up the valley. At Brook Hill there were noticed growing very luxuriantly some Liberian coffee and nutmeg trees at an elevation of 400 feet. Further up the valley we came to Mr. Riviere's property, where a very simple and effective cacao-house was in operation for curing the produce of the estate. Above this the valley narrows slightly, with steep escarpments on either side. Leaving the main valley, and striking across the country in a north-easterly direction, a good view was obtained of the district. We ultimately reached a point below Cassada Garden, where, owing to the rain, we were obliged to make a slight halt and return. The country is broken up into numerous ravines and low mountain slopes, but it is evidently very suitable for purposes of cultivation. Dr. Nicholls has prepared an excellent account of the resources of the Layou flats for the Government of Dominica, and I cannot do better than refer to that document. I was able to satisfy myself that the country for miles around the route taken by us was covered with luxuriant forest growth, that it was well watered, and that the soil was capable of growing almost every kind of tropical produce. In several places the capabilities of the soil have been tested, as at Cassada Garden, where Dr. Nicholls has a small plantation.

Evidently a good road or light railway is necessary to open up this valuable district, and the subject is now, I believe, under the consideration of the Government. Dr. Nicholls enumerates and describes twelve valuable timber trees abundantly found on the Layou flats, and he states that "the forests of these interior flats contain trees of great value for

" building purposes, some of them furnishing hard woods and cabinet " woods of considerable strength and beauty; and it is a fact of im- " portance that the trees producing these valuable woods occur in " abundance, indeed, it has been pointed out by competent authority " that the hard wood trees of Dominica preponderate greatly 'over the " 'fast growing and soft wooded kinds.' "

After leaving the Layou valley we rode up the coast road as far as the old town of St. Joseph, and then took boat to Roseau, where we arrived at 7 o'clock.

December 8.—The morning was spent on the land selected for the Botanical Station, with Mr. Blanc and the Curator, Mr. Green. The lines of the roads, and the positions of the nurseries, propagating sheds, tool-sheds, &c. were laid down, and arrangements made for supplying the land with water. In the afternoon a visit was paid, at the invitation of Dr. Nicholls, to the St. Aroment Estate, where cacao, lime trees, Liberian coffee, and numerous interesting plants have been carefully cultivated for many years, first, by the late Dr. Imray, and now by Dr. Nicholls, F.L.S. This place is one of the most interesting spots in the Leeward Islands.

December 9.—Another visit was paid to the Botanical Station, for the purpose of examining the portion of the land proposed to be set apart for the site of a new hotel and for a recreation ground. Later in the day I accompanied the Governor to examine the land belonging to the Government, on the Morne, and to offer suggestions for its management and control.

In the afternoon, at 2 o'clock, I gave an address at a public meeting held at the Court House, on Cultural industries. The Governor took the chair. The topics touched upon related to the particular subjects suitable for cultivation in Dominica. The principal exports at present are:—Sugar, rum, and molasses, 20,290*l.*; cacao, 12,293*l.*; lime-juice (concentrated and raw), 8,061*l.*; fruits and vegetables, 1,363*l.*; coffee, 398*l.* Limes appeared to be specially suited to the climate and soil of Dominica. From an estimate prepared by an experienced planter it was shown that the cost of establishing a plantation, including the necessary works and buildings, was at the rate of 40*l.* to 50*l.* per acre. At the end of seven years the gross annual return would be at the rate of 18*l.* per acre. On 20 acres, with an expenditure of 1,000*l.*, spread over seven years, a planter, acting as his own manager, could expect to receive, from a lime-estate in full bearing, a gross income of about 500*l.* per annum, yielding a net income of about 250*l.* per annum. In the case of a larger estate the expense per acre would be reduced, and the returns would be correspondingly larger. The cacao industry had greatly extended, and it only required more attention to be devoted to the curing. A large and very valuable fruit industry was capable of being established in Dominica. This only awaits a regular and suitable steam service between the island and the States to enable the people to ship the produce in good order. An account was given of the Gambier plant, and of the conditions necessary to establish regular plantations. The districts of the Layou flats and the Pickard valley were recommended for experimental cultivation with this plant. Particular attention was directed to the objects in view in starting a Botanical Station in the island, and the sympathy and support of all classes were invited to render the work of the Curator as effective and as successful as possible.

Before bringing my visit to Dominica to a close the following summary of suggestions in regard to the Botanical Station were submitted to the Governor:—

The land for the Dominica Botanical Station has been acquired by the Government on a portion of the Bath Estate. It has an estimated area of 40 acres. Within the boundary of the land there are at present six small plots which have been sold at various times. On these are small wooden houses of an unsightly character. It has been suggested to acquire these plots and incorporate the land with that of the Botanical Station. The land lies immediately at the back of the town of Roseau, and about half a mile from the landing place. It is on the right-hand side of the public road leading up the Roseau valley, and terminates near the first bridge over the Roseau river. Immediately above the land, to the south-east, is the Morne, an elevated plateau about 500 feet above the level of the sea. On the edge of the Morne, overlooking the Botanical Station site, are precipitous cliffs, and at the foot of these are easy slopes, suitable for cultivation. The land is of an undulating character, with a rich sheltered hollow immediately under the Morne. In other places the soil is somewhat stony, and not so good for the growth of plants. There is, however, no part of the land not suitable for some cultivation or other. The site is well sheltered from prevailing winds to the south and east. On the northern boundary it is somewhat exposed and will require to be protected by a belt of trees. An abundant supply of water is available from the mains of the Roseau reservoir, which pass through the middle of the land. This water had already been tapped and led in the direction of the spot selected for the nurseries, on the occasion of my visit. There are the remains of stone walls on three sides of the land, and these it is desirable should be repaired and placed in good order as soon as possible. The principal entrance to the Botanical Station should be from the main road, leading up the Roseau valley, and as near to the town as possible.

The plan of the carriage roads through the land has already been discussed and partly carried out. These roads, each of which will be 20 feet wide, will traverse the higher and more gravelly parts, and converge in a circle in the centre of the grounds (where later on a fountain or basin might be placed for the cultivation of aquatic plants). At this spot also seats might be placed under the shade of trees, to allow visitors to admire the view up the Roseau valley or in the direction of the sea. Footpaths will connect the carriage roads with the cultivated part of the land. One footpath will probably be made to pass at a certain height at the foot of the cliffs, to afford a general view of the grounds. The site for the propagating sheds, plant houses, and nurseries has been selected in a sheltered situation and not far from the edge of the depression, with good soil. The depression itself is to be reserved for the permanent cultivation of a set of specimen plants of Liberian coffee, cacao, nutmegs, cola, black pepper, vanilla, gambier, and other plants likely to suit the locality. There are already some bananas, cacao, and lime trees on the land.

As the land is larger than is absolutely required for the nurseries, beds, and experimental plots of a Botanical Station, it may be desirable to lay down such parts as are not immediately required in grass, and plant it with shade and ornamental trees. A few cattle or sheep could then be grazed on these areas.

A portion of the land towards the north-east is suggested as a recreation ground. There is no public recreation ground in the neighbourhood of Roseau, and the acquisition of this site is felt to afford a good opportunity for supplying this want. The total area proposed to be devoted to a recreation ground is about 2½ or 3 acres. This will be entirely away from the cultivated part of the station land, and, if suitable arrangements are made for its up-keep, it will not interfere with it in any way.

Great stress has been laid on the objects in view in establishing this Botanical Station at Dominica. Its function has been defined as strictly of an experimental and economic character, ornamental plants are to be grown in moderate quantities for rendering the grounds attractive and interesting, but chief attention will, it is hoped, be devoted to the plants of an economic or industrial character, and especially those likely to be in demand for establishing new plantations in Dominica. A list of such plants is given elsewhere. Again, the more the cultural operations of every kind are carried on as object lessons for the instruction of the people the better will the station fulfil its mission as an important factor in developing the resources of the island. A large number of very useful and interesting plants already exists in the island at St. Aroment, the property of Dr. H. A. A. Nicholls, F.L.S. These have been sent out from time to time from Kew to the late Dr. Imray and Dr. Nicholls, in exchange for Dominica plants kindly contributed at the private expense of the gentlemen just named. The collection is now the best in the Leeward Islands. A list of these plants is given in the *Kew Bulletin* for July, 1887, pp. 10–12. Dr. Nicholls takes a deep interest in everything connected with the development of cultural industries in Dominica, and he has very generously offered the Government, without charge, any cuttings, seeds, bulbs, or plants which can be spared from St. Aroment for the purpose of establishing the Botanical Station and for distribution in the island.

After the meeting in the Court House I accompanied the Governor on board the "Esk," and left at 6.30 for the northern islands. It was arranged that I should land at Montserrat and carry out the work of my mission there, while the Governor returned to Antigua to dispose of the mail correspondence. We were to meet at St. Kitts a few days later.

MONTSERRAT.

Montserrat, a Presidency of the Leeward Islands, has a total area of 32½ square miles, and a population of about 11,000. It is composed of a series of rocky hills with conical peaks (2,500 to 3,000 ft.), and from these there are sometimes steep, sometimes gentle slopes reaching down to the sea. The whole surface is broken up into valleys and ravines, with here and there some fertile open country covered with sugar-cane fields. The higher slopes and summits of the mountains are covered with dense forests, with cabbage palms, tree ferns, wild bananas, and valuable timber trees. The principal productions are sugar, lime-juice, sweet potatoes, yams, eddoes (*Colocasia*), pigeon peas, cassava, arrowroot, aloes, ginger, Indian corn, and numerous tropical fruits.

The chief town is Plymouth, on the western coast. The enterprise of the Montserrat Lime-juice Company in growing limes and manufacturing lime-juice has given this little island considerable commercial importance of late years.

December 10.—The "Esk" touched at Montserrat at daylight. I landed at Plymouth with the Commissioner, Mr. Edward Baynes, who had come on board to call upon the Governor, at 7 o'clock.

I first paid a visit to the Botanical Station in course of being laid out to the south-east of the town, close to the sea shore. The spot is very small, but it is the only land available to the Government for the purpose at the present time, and, limited though it be in extent, it can be rendered of great service as a nursery or depôt for plants and for maintaining a small representative collection of such trees and shrubs as are suitable for growing in the island.

As the Commissioner was unable to accompany me on a general visit to the principal centres of cultivation, arrangements had been made for me to have the pleasure of doing so with the Hon. J. S. Hollings, C.E., a most intelligent and well-informed resident, who was thoroughly acquainted with the country. In addition, I was fortunate enough to receive an invitation from Mr. Hamilton, the able manager of the Montserrat Company, to visit the estates under his charge and have an opportunity of seeing the many new industries in course of being established in the island. We left Plymouth about 9 o'clock, and after riding along the sea shore for a short distance to the northward past Bransby Point, we struck inland and visited the Elberton Lime Estate, where they were gathering their annual crop of limes for making into lime-juice. Owing to the drought the fruits were not so large this year as usual, but the immense golden heaps collected in the fields and near the factory were trophies of a harvest well worth travelling all the way to the West Indies to see them. The West Indian lime (*Citrus medica*, var. *acida*) appears to be a thin-skinned local variety, little known outside the West India Islands. It yields juice of a singularly pure acid flavour, and it deserves to be much better known in this country in the fresh state for making "lemon" beverages, as well as for general use in cookery. The enterprise of the Montserrat Company extends to other things besides limes. Nevertheless, from limes alone it is possible to produce a variety of articles more or less valuable. The limes themselves are exported as gathered, or they are preserved in salt water and shipped in a pickled state for consumption in certain parts of the United States. Lime-juice, obtained by compression, is exported either raw or in a concentrated state. This latter is obtained by evaporating the raw juice in boilers until it is reduced to about one twelfth of the original bulk, when it is ready for export as a dark, viscid substance like molasses. This is used for the preparation of commercial citric acid. From the rind of the fruit, by a process known as "ecuelling," which consists of gently rubbing the fruit on rounded projections arranged inside a brass basin, a very fine essence of limes is obtained. Again, by distilling the raw lime-juice a spirit is obtained known as oil of limes.

From Elberton Estate we travelled further inland through groves of lime trees, and reached Olveston Estate. Here also was a large centre of activity in connexion with the utilisation of the produce of the lime tree. The business of the company was evidently carried on with great energy and enterprise, and Mr. Hamilton, who had formerly been a planter in Ceylon, was thoroughly alive to the desirability of turning to account everything that the land could produce. Some excellent cacao had been cured on the Ceylon method, and while ordinary Montserrat cocoa fetched about 60*s.* per cwt., this cocoa had been valued as high as 90*s.* per cwt. There was also some very well cured coffee grown on the hill slopes above. In a small factory close at hand there was in course of preparation the juice of the papaw, to be made into "papaine," or vegetable pepsine. A tree grown in a garden here as mangosteen proved to be a species of *Clusia*, with male flowers only. After lunch at the Cot, a charming residence on a commanding spur of Centre Hill, a hasty visit was paid to the cacao plantation in the valleys below. The sorts under cultivation were chiefly good Forastero cacao, with here and there a tree of Criollo cacao. These two could easily form the nucleus for a most valuable plantation. From the Cot we rode down through several ravines, with bananas and cacao, to the stock farm, and ultimately to the Company's arrowroot works. Here, with the best appliances and machinery, and under circumstances conducive to the utmost cleanliness, a comparatively new industry for Montserrat was in course of being established. Very fine plants of *Furcræa gigantea*, yielding the Mauritius hemp of commerce, were plentiful in this neighbourhood. They were used chiefly as hedge plants. An elementary school for negro children is maintained by the Montserrat Company in the neighbourhood of their estates. It is said to be one of the best in the West Indies.

We now travelled in an easterly direction, and visited Water Works sugar estate, owned by Mrs. Kirwan. In the valleys above the house was a small but very promising cacao estate. On the ridges of the hills were clusters of an interesting native palm (*Cocos amara*) with the habit of the cocoa-nut. The fruit is about 2½ inches long. After traversing one or two deep valleys we arrived at Richmond, Mr. Hollings' estate, at nightfall. Mr. Wade, the Curator of the Botanical Station, brought up a sketch plan of the ground, and arrangements were made to have the paths and beds pegged out, ready for my inspection the next day.

December 11.—Leaving Richmond at 7 a.m., and again accompanied by Mr. Hollings, it was arranged to cross the island and see something of the windward side. It was afterwards proposed to take a southerly direction and ride round the soufrière into Plymouth. As will be seen later, this part of the programme was not possible to carry out in the time. From Richmond the road was through Dagnam Estate up to the great saddle of depression between the Centre Hill (2,450 feet) and the Soufrière Hill (3,002 feet). This is the main line of communication between the leeward and the windward sides of the island. The road at its highest point crosses the ridge at about 1,200 feet. Along this road excellent views were obtained of the country on both sides of the ridge. In addition to the regular sugar estates, of about 200 or 250 acres each, there are numerous thriving negro villages where the land is held by small freeholders. In the neighbourhood of these there are patches of fruit and provision grounds in a good state of cultivation. Sweet potatoes, yams, eddoes, pigeon-peas, and fruits and vegetables of island production are cheap and abundant. It is estimated by Mr. Hollings that there are about 1,200 negro freeholders in Montserrat, owning lots varying from one to five acres each. In the cooler climate of the hills many of the northern fruits and vegetables could be grown, but as there is little or no demand for them in the island, and as the facilities for shipping them are fitful and uncertain, they receive little attention at present. On the windward slopes the country is much broken up into deep ravines and rocky defiles. The soil in the valleys is, however, very rich, and where these are wide and sheltered from prevailing winds they offer excellent localities for purposes of cultivation. The sugar estates occupy slopes and declivities close to the sea. The climate is cooler than on the leeward side, and the air more bracing. At Hermitage, a representative sugar estate, Mr. Wilkins was good enough to show us his cultivation. He had tried the Caledonian Queen, or St. Kitts' cane, on one of his fields, and it had stood the drought much better than any of the other canes. Young cocoa-nut palms were in a very flourishing condition. In a deep ravine, reaching up to the mountains, a young cacao plantation was in course of being established. Where not exhausted by the cultivation of provision grounds the soil was good and the plants healthy. In deep valleys of this kind cacao evidently requires little overhanging shade. It practically requires nothing more, after it has started, than shelter from strong winds. In this case the winds came up the valley from the sea; hence shelter belts of galba (*Calophyllum Calaba*) or pois-doux (*Inga laurina*), planted across the trend of the valley would afford the best protection possible. The vegetation in the upper reaches of these deep Montserrat valleys is very striking and luxuriant. Huge trees, with slab-like buttresses, grow on the sides, and these are literally clothed with masses of aroids, ferns, and bromeliads. Depending from their upper branches are numerous lianes and climbing plants, forming festoons of green leaves, relieved here and there by the bright flowers of Ipomœas and Bignoniads. On the tops of the mountain slopes the trees are shorter, with more coriaceous leaves, and covered with masses of mosses and lichens. Here also are numerous tree-ferns and mountain palms, and the ground is carpeted with lycopods and selaginellas.

As I was due at Plymouth early in the afternoon the proposed expedition to the south and round the Soufrière had to be given up. In order, however, to see another district of the island the return journey, which proved a very interesting one, was made over Windy Ridge and back to Richmond, on the other side of St. George's Hill.

At the desire of the Commissioner and the Legislative Council I met a number of the leading proprietors and planters at the Court House, Plymouth, at 4 o'clock, and gave an address on minor industries. The Commissioner took the chair. At this meeting a large number of negro freeholders was present, and they appeared to take great interest in the proceedings. A collection of plants and specimens had been brought together to illustrate the lecture, which resolved itself into a demonstration of methods necessary for pruning and treating different kinds of economic plants and putting up produce, such as bananas, oranges, pine-apples, for shipment.

I again visited the Botanical Station, and the following report upon it was afterwards presented to the Governor:—

The Montserrat Botanical Station is in course of being established on a small plot of land, originally about two acres in extent, to the south-west of the town of Plymouth. It is close to the sea, and about a quarter of a mile from the landing place. It is sheltered on all sides, except that facing the sea beach. A public road runs between the station and the sea, formed out of the original two acres bought by the Government. At the back the land is bounded by a somewhat steep slope about 30 or 40 feet high composed of stone and gravel. This slope is not altogether included in the station ground. It is desirable, however, for the sake of keeping it in order, and forming a suitable background to the cultivation carried on at the Botanical Station to acquire the whole slope or at least to lease it at a nominal rent. It can be of little or no value to the present owner. The boundary on the north side is in contact with some negro huts and waste ground. This boundary should be protected by a barbed wire fence and live posts to keep out trespassers. A good fence of Galba or Lime trees should ultimately be established here. Between the station ground and the public road a rustic fence has been constructed, which appears to answer very well for the present. An entrance to the Station is necessary at the nearest point to the town, and a suitable gateway placed there. The drain or watercourse constructed to carry off the water from the gully in the north-east corner should be walled and paved; and in addition to the present steps, a small rustic bridge might be constructed. A constant supply of water should be distributed everywhere over the station. This is a most important matter and one requiring early attention.

The present Curator, Mr. Wade, was formerly a gardener to Capt. J. H. H. Berkeley at St. Kitts. He has been in the West Indies for nearly 10 years, and is described as a hardworking and a successful gardener. So far as I was able to judge of Mr. Wade after a two days' intercourse with him, I am of opinion that he is competent to carry on the work of the Botanical Station. He should, however, be placed under the immediate control of the Commissioner or some other responsible person, and be encouraged by personal intercourse to take an interest in his work and devote his energies entirely to the duties of his post.

An outline sketch of the manner in which the ground could be laid out was left with Mr. Wade. Immediately adjoining the barbed wire fence to the north, and to the left of the entrance walk, there is soil suitable for a nursery, propagating sheds, and tool shed. Adjoining this, and to the right of the entrance walk, a small banana plantation might be established, to be used as shade for other plants. Beyond this, to the south-west, would come the watercourse, and then a series of beds about 10 feet wide, divided by walks three feet wide. These beds could be devoted to the experimental cultivation of specimen economic plants, all of which should be legibly named. Pine-apples might be planted on the dry stony soils to the extreme west, and also at the foot of the slope. The slope itself might be covered with trees and shrubs of an ornamental character or with Agaves, Cacti, or other plants capable of bearing dry arid conditions. Parallel to the rustic fence adjoining the public road, a border of ornamental plants might be established to give the ground an attractive appearance from the outside. As may be readily gathered from its very small area, this Botanical Station cannot be utilised for much cultivation of an experimental character. Its functions must necessarily be very limited. It should be devoted to the raising of economic plants from seed or cuttings, and to the importation of any special plants from other institutions. It is possible, however, for it to do a great deal of good in this way, and especially if a few specimen plants are well cultivated at the Station for the instruction and observation of the people. The Curator, under such circumstances, should endeavour to place his knowledge of horticultural methods at the disposal of those anxious to become acquainted with them. He should train a few boys as gardeners, and do all that is possible to aid in the development of local industries.

A large number of economic plants already exist in gardens in the island, and the Curator should endeavour to obtain these and establish them at the station before taking steps to introduce others on a large scale. Further, he should make himself well acquainted with the number and character of the economic plants producing seeds or available for cuttings, and so utilise to the best advantage the local resources of the island.

As Montserrat possesses about 1,200 small settlers, with holdings from 2 to 5 acres each, it is very desirable to influence them to take up the permanent cultivation of fruit, spices, cacao, coffee and other products in large demand. In this work the Curator should take an active part.

Immediately after the address it had been intended that I should leave for St. Kitts in the schooner "Georgiana." As, however, the cargo steamer "Mirima" had arrived and was leaving for St. Kitts in a few hours, Mr. Cowie, the agent, was kind enough to arrange for a passage for me in the latter vessel. I went on board after dinner, and arrived off Basseterre, St. Kitts, early next morning.

ST. KITTS-NEVIS.

ST. CHRISTOPHER.—The three islands of St. Christopher, Nevis, and Anguilla form one Presidency, called the Presidency of St. Christopher and Nevis. St. Christopher (or more commonly St. Kitts), lies north-west of Montserrat; it contains 68 square miles and a population of about 30,000. It is a long narrow island somewhat bottle-shape in outline, with the neck pointing towards Nevis. The main portion is between 12 and 13 miles long, and contains several peaks and ridges culminating in one massive peak called Mount Misery (4,060 feet). On each side of the central ridges are rich slopes broken by numerous ravines stretching down to the sea. These slopes present a very cultivated appearance. First come rich expanses of cane-fields with the houses and works nestling among trees, then the higher slopes with the deep verdure of grass lands, and, ultimately, the summits of the peaks and ridges covered with dense forest. The soil of St. Kitts is very rich and productive. It consists of a fine loam, easily worked, with a porous substratum of gravel or disintegrated volcanic rock. In some districts on the higher slopes there is a tenacious red clay, while in the valleys below a sandy loam is prevalent.

St. Kitts is a bright and interesting island. It is very healthy, and the people are enterprising and intelligent. It can grow almost everything suited to the tropics. Its only drawback is an occasional season of drought, when, owing to the porous nature of the soil, vegetation suffers considerably.

There are 135 sugar estates, containing 18,507 acres of arable land. The chief productions are sugar, molasses, sweet potatoes, cassava, ground nuts, pigeon peas, a little coffee, cacao, and tobacco. English vegetables are readily grown at nearly all elevations. The principal town is Basseterre, with a population of 10,000 inhabitants. It possesses several good buildings, including a fine church and court house and an attractive public square and garden.

NEVIS.—The island of Nevis lies south-east of St. Kitts, from which it is separated by a channel about 2 miles wide. Nevis is circular in outline, contains 50 square miles, and a population of about 12,000. About one-half of its 32,000 acres is, or has been, under cultivation. Nearly in the centre of the island rises a majestic peak (3,200 feet) with a dark wooded crater. The slopes of this are at first steep and covered with forest, they then become gradually less steep and undulating, and at last spread out all round towards the sea. The soil of Nevis, derived from the decomposition of crystalline trachytes, is more clayey than that of St. Kitts. On that account it is less easy to work, but it is by no means unfertile. Sugar is the chief product, but a large number of other articles are in course of being experimentally grown. Nevis differs from St. Kitts in the larger number of small proprietors it contains. These cultivate ground provisions and fruits, and, if suitable facilities existed for shipping them, Nevis might become much more prosperous than it is at present. The chief town is Charlestown; this is 12 miles by boat from Basseterre in St. Kitts. A small Government steamer is about to be placed on the service between the two islands.

December 12.—On landing at St. Kitts, I went up to Government House and joined the Governor, who had arrived the day before by the mail from Antigua. After breakfast we drove out to inspect land, under the consideration of Government, to be acquired as a site for a Botanical Station. The first was the land immediately opposite Government House. This was very suitable in regard to soil and position; but was entirely unsuitable on account of the exposure to strong winds. The locality was perfectly flat or slightly sloping towards the south, with no shade or shelter, and it was fully exposed to winds from all quarters. In the comparatively dry climate of this portion of St. Kitts, shade and shelter are absolutely necessary for the growth of tender plants in the plains. Probably no plants except sugar-canes could thrive in such situations during so dry a season as that of 1890–1891.

Another locality visited was to the west of the town of Basseterre, and between it and the site of the signal station and battery. This was somewhat close to the sea, but the soil was good, and a sheltered hollow near the high road, where the canes were growing most luxuriantly, offered an excellent situation for a Botanical Station. A fuller description of this locality is given later. Owing to the absence of a site for a Botanical Station, Mr. Plumb, the Curator, appointed in 1889, had started nurseries and a plant depôt on land placed at his disposal, adjoining the residence of the Commissioner, Captain Churchill. This situation was very dry and so exposed to hot winds that it could only be utilised as an expedient of a temporary character.

At 3 o'clock I delivered an address at the Court House. The Governor took the chair. The subjects touched upon in the address are briefly summarised in *The St. Christopher Advertiser* of the 16th December 1890, as follows:—Mr. Morris "spoke of the advan-
" tages likely to arise if the Leeward Islands would put forth efforts to
" improve their staple industry [of sugar], and to encourage the starting
" of new industries. He sketched the activity displayed by Kew and
" its kindred institutions in the Colonies, and urged the desirability of
" encouraging the scheme for Botanical Stations, and the formation of
" an Agricultural Society, instancing the benefits which have accrued
" to [Trinidad], Jamaica and other countries from such institutions.
" He described fully and clearly the discovery of the cane-seed, and
" his illustrations of the 'arrow' or flower of the sugar-cane were most
" interesting. He then directed attention to the cultivation of coffee,
" cacao, and fibres, and suggested that every endeavour should be
" made by the Colonists to show what the capabilities of these islands
" were, and to invite capitalists to invest their money in the cultural
" industries of the West Indies."

After the lecture was over, I accepted an invitation from Captain J. H. H. Berkeley to visit Shadwell and see some of his experimental cultivations. Potatoes and tomatoes had been successfully grown on cane lands and shipped to the United States as early as December of each year. The only drawback to the development of a large industry in these articles, had hitherto been the length of the voyage from Basseterre to New York. The reports of the agents had invariably been, "if these could have arrived two or three days earlier, they " would have been in excellent condition and realised good prices." Captain Berkeley deserves great credit for his enterprise in this and similar matters. He has shown the way to many new industries, and if the improved shipping facilities now under the consideration of the Government are fully carried out, it would be possible to embark in many enterprises connected with the supply of early fruits and vegetables to the northern markets and secure satisfactory results.

December 13.—A more detailed examination of the proposed site of the Botanical Station was made this morning, and a conference held with Mr. Plumb in regard to its suitability for nurseries and the cultivation of plants. There appeared to be no other locality within a short distance of the town of Basseterre possessing the necessary advantages of good soil and shelter. A ride was taken in the direction of Milligans and Fountains, and a good view obtained at an elevation of about 1,200 feet of the sugar lands of St. Kitts and of the vegetation of the higher slopes. In the ravines were growing very handsome tree ferns, the stems of which were largely used as fence posts. Numerous small ferns clothed the sides of streams and gaily flowered plants such as *Columnea* and *Alloplectus* hung in tresses from the trees. The dense forests of St. Kitts from 1,500 feet to 3,000 feet have evidently not been fully explored. The climate at this elevation was cool and pleasant. Mr. Napier, at Fountains, had a large kitchen garden with green peas and European vegetables in full bearing 12 days before Christmas. With intelligent care and a sufficient supply of water, it is possible to grow almost any kind of vegetables at St. Kitts. The soil is of a fine loamy character, easily worked, and very productive. St. Kitts still deserves its old Carib name of "llaminga," or the fertile isle.

After lunch, at the request of the Governor, I visited some low-lying land to the east of the town of Basseterre, in course of being drained and reclaimed. This locality was formerly a swamp, and being to the windward of the town, caused some unhealthiness. Efforts likely to be in every way successful are being made to cover it with grass, and plant trees upon it. In time it should be available as a recreation ground or a public park. I offered suggestions for the treatment of the land, and recommended trees, such as the Guango (*Calliandra Saman*) Cocoanuts, Java Almond (*Terminalia Catappa*), and certain wild figs as shade and shelter trees. As the soil gradually dries up and loses the salt contained in it numerous other trees might be grown there.

Owing to the pressure upon my time it was impossible to arrange for a visit to the island of Nevis. I was able, however, to meet several persons interested in the industries of Nevis, and to offer some hints in regard to them.

The permanent land for the Botanical Station had not been acquired at the date of my visit. The Curator, Mr. Plumb, had, however, been engaged in raising plants in pots and in nursery beds on a small piece of land adjoining the residence of the Commissioner. This land contained very poor soil, was exposed to dry winds, and had only a moderate water supply. In spite of these difficulties, the Curator had raised several hundred plants of different sorts, and many valuable economic plants were ready for distribution. The success so far attained by Mr. Plumb's efforts showed that he was fully alive to the special work required of him at St. Kitts-Nevis, and I have little doubt that when the land for a permanent station is acquired he will be competent to deal with it. He has a good knowledge of tropical economic plants, and could afford useful information respecting their culture and treatment.

As regards the land for a permanent Botanical Station, the Government had before them two possible sites. One was a flat piece of land immediately in front of Government House, and divided from it by a public road. It formed a part of the gradual slope to the north of the town of Basseterre, and about a mile distant from the landing place. This land, cultivated as part of a sugar estate, contained some good soil, it was easily accessible from the town of Basseterre, and if in other respects suitable would have contributed to the amenities of Government House, and attracted many of the visitors who call from time to time on the Governor. The land had, however, some serious defects. It had a plain unbroken surface, and sloped in the direction of the prevailing winds. It was absolutely without any protection whatever from the north and north-east, whence blow during the greater part of the year strong dry breezes most inimical to plant life. Even with shelter belts grown after many years of persistent effort it would be impossible, I believe, to provide adequate protection, and the necessary humidity in the air to plants on this site. Further, it was liable to be washed away by any catastrophe such as happened at St. Kitts a few years ago, when a disastrous flood did considerable damage within a short distance of this land. I arrived, therefore, at the conclusion that the land was altogether unsuited for a Botanical Station.

The only other site to which my attention was called as likely to be available, was situated to the west of the town of Basseterre, and this also formed part of a sugar estate. It was close to the sea-shore, and extended inland by a series of gradual slopes, all of which were under cultivation. A considerable portion of this land was intended to be acquired by Government for the purpose of extending the town in this direction, and of affording a much needed expansion of the area available for building purposes. I carefully examined this land on two occasions with the view of finding out whether any portion of it was suited for the purposes of a Botanical Station. The rocky land of a broken character to the extreme west was obviously out of the question. The same remark, but for other reasons, applies to the higher portions of the land extending in the direction of the public hospital. In the one case the situation was too dry and exposed; in the other it possessed many of the disadvantages already noted in regard to the land opposite Government House. One portion of the land to the eastward nearest to the town of Basseterre was, however, found to be far more promising. This consisted of a sheltered depression with good soil extending in a line parallel with the sea. The extent of this sheltered land may not be more than 6 to 8 acres. If suitable arrangements are made by throwing up banks, planting live fences, or building good stone walls along the north and north-eastern boundaries of this land it might be rendered very suitable for a Botanical Station. There is a sufficiently large area of good land here for nurseries and experimental plots, and the spot known as "Cholera ground," forming the western limit of it might be laid down in grass and planted with ornamental and shade trees. At present this spot is, and has been for the last 20 or 30 years, under cultivation in canes.

I am fully aware that the land here is very near the sea, and on that account may not prove suitable for the cultivation of many plants that thrive only in elevated places inland. I am aware, also, of the comparative dryness of the sea-coast lands at St. Kitts, and further of the sentimental objection that may exist with regard to associating the Botanical Station with the so-called cholera ground. It must be remembered, however, that according to general consensus of opinion of engineers, doctors, and others, the only possible direction in which the town of Basseterre can be safely extended is to the westward. This neighbourhood will eventually become an important suburb of the capital of the island, and contain some of the best residences dotted about on the ridges above. The grounds of the Botanical Station below will thus naturally prove a source of attraction to an important section of the community, and be easily within reach of all. It will be distant about a mile from the landing place at Basseterre. In the event of this land being acquired, I have already discussed with Mr. Plumb some of the preliminary operations necessary before the station can be satisfactorily established upon it. A sketch outline of the boundaries and roads was prepared, also the position of the office, tool-sheds, nurseries and experimental plots. The great point is to secure adequate shelter from prevailing winds. The next is to secure an unfailing water supply distributed over the whole surface. And lastly, advantage should be taken of the good soil in the hollow to lay out there the nursery beds and experimental plots. The other portion of the land could be laid down in grass and shaded with trees.

As regards the experimental plots, taking into account the fact that the principal industry of the island is sugar, and that the planters are very anxious to increase the yield per acre, the Curator might carry on investigations in regard to sugar canes on the following lines:—(1) the relative merits of different varities of canes, (2) the effect of certain manures on sugar canes in increasing the yield of sugar, (3) raising new varieties of the sugar-cane from seed, and (4) observations on plants and on insects injurious to the sugar-cane.

The work of the Botanical Station at Barbados might usefully be followed in this respect at St. Kitts; and if an agricultural chemist is appointed, the latter might be invited to join the Curator in watching and recording the results in a systematic form for the information of the St. Kitts' planters. These experiments, when in full working order, might be carried on in part only at the Botanical Station. They might be carried on more fully on some estate close at hand, where facilities are available for crushing the canes and obtaining results on a larger scale. The other experimental plots might be devoted to the growth of Egyptian cotton, tobacco, vanilla, trees yielding tanning substances, fibre plants, fruit trees, cacao, Arabian coffee, Liberian coffee, arrowroot. It is desirable, to save expense, that only a few plots be worked at one time. The nurseries should, however, contain a good supply of all plants likely to thrive in the island, and specimens of each should be established on the station land, and cultivated according to the best methods adopted in other countries.

Some of the indigenous plants of St. Kitts are very interesting. All likely to thrive in the lowlands should be established at the Botanical Station, and the Curator might be encouraged to make collections both of living and dried plants illustrative of the flora of the island. For this purpose he should be provided with a horse and a "modified horse allowance."

The Botanic Station at St. Kitts will probably be found unable to meet satisfactorily the requirements of the island of Nevis. A plant depôt, or possibly another station, will eventually be required there. Nevis is essentially an island of small settlers, and these people are likely, if encouraged, to take up the cultivation of fruit and vegetables, and supply freight for the new steamers proposed to be established between the Leeward Islands and New York. For the present the Curator might visit Nevis at certain intervals, and make himself thoroughly acquainted with its circumstances and requirements. He will then be in a position to judge exactly whether these latter can be met from the St. Kitts Station or not.

This evening, at the request of the Governor, I embarked with him on board H.M.S. "Partridge" (Lieut.-Commander Noel, R.N.) for the purpose of visiting the island of Anguilla. This island, owing to a prolonged drought extending over nearly a year, was in a very critical state, and the people, about 3,000 in number, were reported as almost in a starving condition. The Legislative Council of the Presidency had voted certain sums of money from time to time towards alleviating the most urgent cases of distress, and if rain came it was hoped that some early maturing crops would be possible to be grown. The "Partridge" left Basseterre about 6 o'clock, and coasted along the leeward shore in the direction of St. Eustatius to the north-west. From whatever point of view one looked upon St. Kitts it presented a singularly bright and cultivated appearance. Later in the evening, when storm clouds broke over the top of Mount Misery, the fanciful resemblance of mountains and clouds to the figure of St. Christopher noticed by Columbus was fully realised. St. Eustatius, celebrated for "its most perfect crater possible," making up five-sixths of the island, was passed during the night, as also Saba, where a community of Dutch and negroes lives in the bosom of an old volcano, with only one small landing place and a stair leading up 800 feet into the town.

Early the next (Sunday) morning we found ourselves passing Dog Island and Prickly-pear Cays, outliers of Anguilla, and making for Crocus Bay, an open roadstead well sheltered from the north-east trades. The coast line at this point was about 150 feet high, formed of, probably, tertiary calcareous marls. On the highest point was a neatly built court house, with a flag-staff and signal station. Below the cliffs in this spot was a small margin of beach with bright glistening sand, suggestive of those curious nullipore sands formed from the calcareous skeletons of certain algæ.

ANGUILLA.

Anguilla (little snake) belongs to the Presidency of St. Kitts-Nevis, and is distant 60 miles north-west from the former island. It contains 35 square miles, and a population of 3,000. It is a long, narrow island, somewhat flat, and in its physical features singularly uninteresting. The elevations are chiefly along the coast, the interior recedes from the coast, and forms a basin-like depression. In recent books, descriptive of the West Indies, it is stated that there is a salt lake in the centre of the island. If this occupied the basin-like depression above mentioned, this lake must have disappeared many years ago. The island is fully exposed to the trade winds, which sweep over it with considerable force during the greater part of the year. There are few or no swamps, and the place is extremely healthy. The energies of the people are chiefly devoted to the manufacture of salt, to raising ground provisions, and to rearing cattle, ponies, and small stock. These are shipped to St. Thomas, where they find a ready market.

December 14.—The Acting-Magistrate of Anguilla, Mr. Edwin Baynes, came on board to receive the Governor, and it was arranged we should land immediately after breakfast. On going ashore we were supplied with ponies, and we first of all attended service at the Anglican Church. After service we rode in the direction of the cultivated portions of the island and saw the remains of gardens and provision grounds that had been completely abandoned on account of the drought. A little rain had fallen the previous week, but it had done little to moisten the soil, which was dust-dry to a considerable depth. We went on board for lunch and returned immediately after. The Governor held a conference with the principal inhabitants to devise means for alleviating the destitution of the people, while, at his request, accompanied by Captain Noel, I made myself acquainted with the character of the country, with the view of suggesting some plants that would be likely to thrive in so unpromising a country. We first of all examined a large district to the north of the Settlement. The surface here was almost entirely covered with a porous limestone, in the cracks and fissures of which some trees and shrubs of a scrubby aspect managed to grow. Here and there in glades were some patches of a shallow red soil formed by the disintegration of the limestone. In this soil, during such seasons as moderate rain fell, the people grew cassava, pigeon-peas, sweet potatoes, okro. At the time of my visit, hardly anything green was seen except some species of *Agave*, *Opuntia*, *Cereus*, and the vegetation peculiar to rocky cliffs in the tropics. The gommier (*Bursera gummifera*) was the largest tree seen, while small stunted plants of *Eugenia*, *Phyllanthus*, *Elæodendron*, and weedy looking Crotons formed the bulk of the undergrowth. Such land was evidently useless for purposes of cultivation, except for occasional and precarious food crops, and these could only be satisfactorily grown during seasons when there was a plentiful supply of rain. Some of the brushwood was capable of being converted into charcoal, but there was no market nearer than St. Thomas, and the means of communication were few and far between. Some grass was growing here and there in cool hollows, and the goats, cattle, and horses, if supplied with water, could pick up a somewhat scanty existence. More might be made of the patches of land suitable for pasturage purposes, for some kinds of grasses are known to thrive where almost every other vegetation fails. We rejoined the Governor at nightfall and went on board. It appeared that the privations at Anguilla were not entirely owing to the drought. A large number of the men had been regularly employed in digging phosphates on the island of Sombrero. Their employment there, however, had suddenly ceased, and this, combined with the prolonged drought which had overtaken them at Anguilla, had left them almost destitute.

December 15.—We landed this morning soon after 6 o'clock. We went off into the interior of the island in a north-easterly direction towards the revenue hut near Sandyhill Bay. The country here sloped gradually towards the eastward, was less rocky, and in one or two depressions there were the remains of sugar estates which had been in cultivation within the last 30 years. The soil was fairly good and there was some shelter from wind. The trees in this neighbourhood were larger and finer than those seen the day before, and water was obtainable from deep wells even in the driest weather. Careful search was made for any plants in the island that would be likely to afford the means for starting a fibre industry. There were numerous species of *Tillandsia*, *Pitcairnea* and other plants of this character on rocks and trees; but only one species of Agave was found, and that was, unfortunately, one that yielded a very inferior class of fibre. It was useless, therefore, to attempt the systematic cultivation of this plant. After considerable difficulty, one plant of *Furcræa cubensis* was found on land to the north-west. This it appears had been introduced there. The leaves were of good length and texture, and the fibre was excellent. It was evident that if two or three thousand acres of absolutely useless land in Anguilla could be established with fibre plants in a few years an important industry might be started there. The cost of clearing the land, if started as relief work, would be very small; while plants could be obtained from Antigua, Jamaica, or some other islands to the south.

From the number of wells existing in various parts of the island, it is evident that it should be possible to obtain a supply of water all the year round. The public well near the Settlement, lately placed in a state of thorough repair by Government, yielded at the end of a prolonged rainless season, an abundant supply of water. In other parts where the wells were private property they appear to have been neglected and become useless. It is well known that in eastern countries where there are seasons of prolonged drought, water for irrigation purposes is obtained from wells. By such means large crops are regularly raised, and the cultivator is almost entirely independent of the seasons. At Anguilla, where the trade winds are so regular, motive power for pumping well water might be obtained from Canadian wind-mills or by horse or cattle labour. The matter is well worthy of consideration. The people as regards agricultural matters have an air of shiftlessness about them which is very unlike the patient plodding habit of their eastern brethren. If water for irrigation purposes could be placed at their disposal, there should practically be an end to these periodical visitations of short crops and privations.

Although the greater part of the land at Anguilla is rocky and poor, there are scattered patches capable of cultivation, but the present race of people is quite incapable of initiating anything more than will provide them with the barest necessities of life.

From the north-east coast we retraced our steps in the direction of the Settlement and made for Blowing Point, on the extreme south-west of the island. For some time we could look across a narrow strait separating Anguilla from St. Martin. This latter (a slightly larger island than Anguilla) is divided between the French and Dutch. The French coast faces that of Anguilla. It is more hilly than the British island, and appears to have suffered less from drought. There is a regular traffic in small boats maintained between the two islands, and smuggling (looked upon as a very venial sin indeed in these remote places) is somewhat prevalent. Before arriving at Blowing Point, an interesting little palm was found growing on broken limestone rocks. It was present in fairly large quantities, and the fan-shaped leaves were used for thatching native huts. The chief interest attached to this palm is connected with its dwarf habit. The largest and apparently most matured specimen did not measure more than about 30 to 35 inches in height, and the stem was about 2½ inches in diameter. I was unable to find any plants in flower or fruit, but there was no doubt it was a species of *Thrinax*. I brought away with me about 30 to 40 plants to be established at the Botanical Stations at Antigua and St. Lucia. The largest specimen was reserved for the Museum of Economic Botany at Kew, where it was lately seen by Herr Wendland, an authority on palms, who is of opinion it is new to science. He has suggested a name for it, but this cannot be published until some of the flowers or fruits are obtainable for a botanical description of the species. It is somewhat singular that only last year a new dwarf species of *Phœnix* of similar habit was discovered in the East Indies, a specimen of which is now growing at Kew. This is likewise about 25 to 30 inches high with a slender stem, and forms a very attractive plant. The Anguilla *Thrinax* is not yet introduced in the living state to this country, but when it is there is little doubt it will prove most interesting and attractive in a horticultural sense. I made, as mentioned above, a special search for flowers or fruit of this plant. I was told that it produced a very pretty pink flower. This, when produced, proved to be an epiphytal orchid, a species of *Epidendrum*, which attached itself to the stem of the small palm and pushed its flowers through the fronds. The nearest species to the present plant is probably *Thrinax radiata* found at Barbuda and other localities in the Leeward Islands. That, however, grows to a height of 15 to 20 feet, and forms a stem 3 or 5 inches in diameter.

After passing Blowing Point we descended to sea-level and visited the salt pond near Road Bay. Salt-making is practically the only important industry in the island, and unfortunately just now it is rather a precarious one. The lessee pays the Government a rent of 200*l.* per annum for the right of making salt, but the success of the crop depends so much on the weather that there is no opportunity of employing more than a very limited number of people. We were unable to continue our way along the sea-coast to Crocus Bay, so had to ascend a steep escarpment and traverse a rugged path across the country in the direction of the Court House. When we arrived there the Governor held an informal levee, and patiently listened for more than an hour to those who wished to bring their grievances before him. After this he gave an address to the people, and explained carefully to them the arrangements made for carrying on relief works. These in the first instance were to be started in connexion with the repairs of the roads, and afterwards extended, if found absolutely necessary, to the clearing of land for a fibre industry. An offer was made to the able-bodied to find work for them at St. Kitts or Antigua, and transfer them and their families to estates where they would have cottages free and regular wages. Very few seemed disposed to accept this offer. The Governor added that the very aged, the infirm, and young children only were to be supplied with food without labour. Seed for planting was proposed to be distributed in order to enable early crops of peas, beans, and corn to be raised.

We went on board the "Partridge" early in the afternoon. We immediately got under way and made for the Virgin Islands. It was hoped we should have time, at least, to touch at Tortola, 90 miles away, and then push on to catch the mail steamer due to leave St. Thomas for the southern islands on Tuesday evening. There was a moderately rough sea during the night, but at daybreak we were well within reach of the outer fringe of the Virgin group.

VIRGIN ISLANDS.

The Presidency of the Virgin Islands consists of 30 to 40 small scattered islands to the east of Porto Rico. Geologically speaking they form a submarine prolongation of the mountain system of that island. The total area is about 58 square miles, and the estimated population under 5,000. The principal members of the group are Tortola, Virgin Gorda, and Anegada. The latter, as its name implies (the inundated), is merely a low reef elevated a few feet above the level of the sea. It has an area of 14 square miles. Tortola, 26 square miles in extent, is composed of hills, the highest of which rises to nearly 1,600 feet. The surface is much broken up into ravines or "gullies," and nearly the whole of it has been under cultivation. Virgin Gorda, 10 square miles in extent, is also hilly, but less fertile than Tortola. Copper mines have been worked here, but at present they are not productive. The inhabitants of these islands are hardy and skilful seamen. The climate is cool and healthy. Hurricanes occur at intervals, and are very destructive. The principal productions are coarse sugar, cotton, and ground provisions, which are sold at the Danish port of St. Thomas. Fishing is largely pursued, and poultry-raising is very successful.

Road Town, a small place on the south-side of Tortola, is the capital of the group.

December 16.—The navigation amongst the Virgin Islands, owing to the presence of reefs and currents, is very difficult, and requires great care and judgment. Although we sighted the islands at daybreak, it was nearly 8 o'clock before we arrived off Road Town, the chief town and seat of Government of the Virgin Islands. From the harbour it presented a broken-down and ruinous condition, evidently the result of the terrible hurricanes of 1867 and 1871. Soon after we dropped anchor, the President, Mr. Edward Cameron, came on board, and the Governor, the private secretary, and myself went ashore. While the Governor was engaged on public affairs I was fortunate enough to have as guide, Mr. Campbell, the Colonial Surgeon, who kindly lent me a pony and took me first of all to the top of the ridge. The land appeared to have been cleared at one time and cultivated with great enterprise. The remains of sugar works were still seen, but the cultivation had long ago given place to coarse grasses, tropical weeds, and scrub growth of an uninteresting character. The soil was evidently good, and on the hill slopes it could maintain excellent pasture grasses. An Agave, which, according to Baron Eggers is *Agave Morrisii*, Baker, the Keratto of Jamaica is found abundantly everywhere. An attempt was being made by Mr. Campbell to start a fibre industry in connexion with this plant. If, as is supposed, it is identical with the Jamaica plant, the fibre is not of great commercial value. The reports received respecting fibre prepared from it by the Death and Ellwood machine at Jamaica were by no means satisfactory. The reports were as follows:—

(*a.*) *Keratto fibre.*—This fibre is of little strength, and is undesirable; value 12*l.* to 14*l.* per ton; it is not an even fibre, and it gives, hence manufacturers find it very difficult to know what they are to do with it, and will not entertain it. It is very similar to a fibre that comes from Spain (Ide and Christie);

(*b.*) *Keratto fibre.*—Very towy; not well cleaned, value 16*l.* per ton (Collyer).

On returning to the town some plants of *Furcræa cubensis* were found on land to the westward, and also a patch or two of *Sansevieria guineensis*. Both these are excellent fibre plants. The latter yields fibre that could be used for weaving purposes, and the demand for it would be practically unlimited. Just now these Virgin Islands require nothing so much as a careful examination of their resources, and a clear and definite statement of what is capable of being successfully grown there. The old condition of things cannot be recalled, and if it were not for the great extent of land now being devoted to the growth of fibre plants in all parts of the world, a fibre industry might be strongly urged upon the people of these islands. As it is, there are numerous small industries that might be taken up, and it is hoped that the impetus given to cultural industries by the establishment of Botanical Stations in the Leeward Islands will eventually do much to give a fresh start to more than one industry suited to the circumstances of the Virgin Islands.

We left Road Town before mid-day, and threading our way amongst the intricate passages of the smaller islands, we coasted along the leeward side of the Danish island of St. John, and arrived in the harbour of St. Thomas at 3 o'clock. The Royal Mail steamship "Esk" was lying at anchor there, ready to start on her voyage southward to Barbados at 6 o'clock. The English Consul came on board the "Partridge," and afterwards accompanied us on shore to call upon his Excellency, Colonel Arundrup, the Governor of the Danish West Indies.

At 5 o'clock we took our leave of Commander Noel, with whom we had made a most interesting and successful voyage, and went on board the "Esk" (Captain Powles).

December 17.—We arrived off St. Kitts at 8 a.m., and Nevis at 10.30 a.m. We had a fair passage from these islands to Antigua, where we arrived at 4.30 p.m. Here I took leave of the Governor, his Excellency Sir William Haynes Smith, with whom I had spent 21 very busy and interesting days in the Leeward Islands.

December 18.—I continued my voyage southward again, passing Montserrat and Guadeloupe, and arriving at Dominica at 1.30 p.m. By arrangement with the captain, I was enabled to go ashore and pay a final visit to the Botanical Station, where I was met by Dr. Nicholls and Mr. Green. The fences had been repaired, the traces for the roads and paths had been surveyed, and the water had been laid on. The site is a most suitable one for a station, and it should prove in time one of the most interesting and attractive gardens in the whole of the West Indies.

WINDWARD ISLANDS.

St. Lucia.

St. Lucia has an area of 243 square miles, and a population of about 45,000. The surface is very hilly. The main axis of elevation trends from north to south, with numerous ridges and peaks separated by deep valleys. Some of the sharp jagged peaks attain an elevation of 3,000 feet. The scenery depends for its beauty on bolder and more clearly marked features than are found in the other islands. In the Pitons district it is singularly picturesque. The hill sides are generally steep and covered with forest. The valleys are very rich and fertile; the most noted of these are the Mabouya, Roseau, and Cul-de-Sac valleys. Two large districts in the northern and southern portions of the island consist of comparatively level country. There is an abundant supply of moisture from frequent showers, and vegetation seldom suffers from drought. At present only a small extent of land is under systematic cultivation. There are several large sugar factories or usines, the most prosperous at the present time being that at Vieux Fort in the extreme south. Excellent crystallized sugar is produced, as also molasses and rum. Cacao, coffee, ginger, annatto, black pepper, vanilla, graines d'ambrette or vegetable musk (*Hibiscus Abelmoschus*), arrowroot, tous-les-mois (Canna), yams, sweet potatoes, various peas and beans, fruits and vegetables, are grown in small quantities. It is evident that the agricultural development in the interior of St. Lucia has hardly yet begun. There are extensive tracts of splendid land yet untouched, and while some of the valleys could be established with thriving sugar estates, the higher and healthier lands are well adapted for large and successful plantations of coffee and cacao.

The climate of St. Lucia is undeservedly classed as unhealthy. The unhealthiness is entirely confined to a few swampy enclosed valleys, and the danger from venomous snakes (found only in this island amongst the British Lesser Antilles) has been greatly exaggerated. The chief town is Castries, with a population of 6,000, it possesses an excellent harbour and is becoming an important naval and military station. Since a swamp to the windward of the town has been filled up and the drainage improved Castries is acquiring a healthy character.

Soufriere, near the Pitons, is the next town in importance to Castries, with a population of about 2,000 souls. It is the centre of an interesting agricultural district, where sugar, cacao, fruit, and spices are grown.

December 19.—I landed at St. Lucia from R.M.S. "Esk" at 6.30 a.m., and visited the Botanical Station. The Curator, Mr. Gray, was laid up at home with an attack of illness. I rode up to Government House on the Morne, and was the guest of His Honour C. C. Knollys, C.M.G., the Administrator. The forenoon was devoted to correspondence for the mail. After lunch I again visited the Botanical Station with the Administrator and the Hon. Charles Chastanet, President of the Agricultural Society. We were met by the Hon. Henry Reeve, Colonial Engineer, who at present has executive charge of the station. We discussed carefully the steps necessary to be taken to lay out the ground and drain it. Also the best arrangements for planting the land with shade trees and economic plants.

December 20.—Correspondence occupied the morning, and I then visited the Botanical Station by appointment with the Curator, who was so far better that he could attend to his duties. The ornamental plants in the garden were well cultivated and in good order. A large central bed was entirely devoted to roses. In the borders on the north and east were numerous plants doing well. A good fence of *Furcræa* divided the garden from the public road on the eastern boundary. The nurseries contained a moderately large stock of economic plants, including such fruit trees as oranges, citrons, limes, and grafted mangoes, purple guava, sweet sop, sour sop, and custard apple, pine-apples and *Flacourtia Ramontchi*, fibre plants such as *Furcræa gigantea*, *F. cubensis*, *Sansevieria guineensis*, *Musa textilis*, *Agave rigida*, var. *sisalana*, and *Boehmeria nivea*. General economic plants such as Arabian and Liberian coffee, annatto, coca, black pepper, vanilla, ginger, cardamoms, arrowroot, cacao, nutmeg, cola, and Nicaragua rubber (*Castilloa elastica*). Besides large and small plants of the above, there were represented about 30 species of palms, about 40 varieties of crotons, and numerous other plants of an ornamental character. The Curator reported that black pepper and vanilla "throve splendidly at St. Lucia." Mr. Gray further added that the particular sort of arrowroot found in St. Lucia, lately tried at Trinidad, is said by Mr. J. H. Hart to have yielded 40 per cent. more fecula than the sort ordinarily grown in that island.

After lunch I accompanied the Administrator to examine the land to the west of the Station. Some negotiations had been undertaken by Government with the view of acquiring this land. The nearest portion to the Botanical Station was a swamp, which, on sanitary grounds alone, ought to be filled up or drained as soon as possible. The other part had a small area of good land in a hollow cultivated with sugar cane. The sides and slopes of this were in grass with a poor, clayey soil. A visit was afterwards paid to a cocoa-nut and cacao plantation belonging to the Hon. Alexander Clavier, Registrar of the Royal Court. This plantation was close to the town of Castries, and in a very promising condition. The cacao, at the time of my visit, appeared to suffer a good deal from the depredations of rats. We rode back to Government House along the Dennery Road, and called to see an excellent kitchen garden with all kinds of English vegetables, belonging to Captain

Hellard, R.E. This was on the Morne at an elevation of about 800 feet.

December 21.—After lunch the Administrator was good enough to ride with me along the main road across the island from Castries to Dennery. This road passes along high narrow ridges, spurs of the central mountain system of the island. It dips under the high peak of Piton Flor, and then gradually descends into the Mabouya valley at the back of Dennery. Its highest point of elevation is about 1,200 feet. For the most part the soil of the district is composed of a stiff, red, tenacious clay. This is very slippery after rain. In the central portion of the island the road passes through a dense forest containing large forest trees, palms, tree ferns, and in wet open places masses of balisier (*Heliconia*). Numerous species of small ferns clothed the banks, as also *Lycopodium cernuum* and *Selaginella flabellata.* There were large expanses of excellent forest land at the head of the Mabouya valley, and cultivation was largely spreading in this direction, which, although on the windward side, was sheltered by the numerous ridges extending from the Piton Flor and Sorcière.

It was evident that in these interior valleys the land is well suited for cultivation. At present there are no roads to reach them. A road projected from the Cul-de-Sac valley into the Mabouya valley, known as the Goldsworthy Trace, would have opened up one of the most fertile portions of the island from coast to coast. This road, unfortunately, was never completed. Cacao is grown in numerous small patches in the Mabouya Valley.

We met parties of peasants carrying half-cured cacao on their heads to Castries, as evidently no other opportunity offered for disposing of their produce. A few coffee bushes still lingered in patches at high elevations, showing that the soil and climate were suitable for the plant, but apparently that other circumstances of capital and labour were not favourable for its extended cultivation. The hot humid valleys of St. Lucia could grow Liberian coffee to almost any extent.

December 22.—This morning I started at 5.30 to accompany Mr. Chastanet on a ride to the northern portion of the island, through Choc and Union Estates to the Marquis section. This part of the country is almost entirely denuded of forest. The lowlands have long been in cultivation under sugar, but the area is becoming more restricted than formerly, and the estates are being turned into pasture. The sugar industry in St. Lucia has become depressed owing to over-speculation just before the low prices of 1884–86. Much money was then lost in connexion with the *usines* as well as on small estates. Under favourable circumstances sugar-growing should be as prosperous in St. Lucia as anywhere in the West Indies. In the meantime there are numerous other industries capable of development, and in the opinion of Mr. Chastanet and others who know St. Lucia well, a system of *Credit Foncier* similar to that in existence at Mauritius would be the means of giving a great impetus to the agricultural development of the island. The vegetation of the northern portions of St. Lucia, where the climate is dry and the soil is comparatively poor, differs greatly from that met with in the central portions. Plants of *Furcræa cubensis, Bromelia Pinguin*, and some logwood were noticed along the roadsides, and these, as well as the Gommier (*Bursera gummifera*), the white Cedar (*Tecoma Leucoxylon*), and *Coccoloba uvifera* are sufficiently indicative of a smaller rainfall and a diminished fertility of soil.

We returned to Castries about mid-day.

In the evening, at the request of the members of the Agricultural Society, I gave an address in the Court House. His Honour the Administrator took the chair. A full report of this address was given in the *Voice of St. Lucia* of the 3rd January 1891. Attention was drawn to the aim and object of the Botanical Station and to the desirability of utilising it as a school of practical horticulture for the young men of the Colony. A detailed account was given of the system of cultivation and treatment desirable to give to cacao, coffee, fruits, vegetables, spices, Egyptian cotton, fibres, tobacco, fodder grasses, cocoa-nuts, limes, pimento, logwood, and other subjects likely to be successful at St. Lucia. Attention was drawn to the reports already published respecting the soils of St. Lucia by Mr. Albert Codé; the experimental cultivation of tobacco undertaken at St. Lucia in 1882–1884; the "Forests of St. Lucia," by Mr. E. D. M. Hooper; and the Crown Lands' Regulations passed in Executive Council on the 5th November 1890. In the latter (section xi.) it is stated that "Sales (of "Crown lands) by auction shall be for cash, or on such other terms "and conditions as may, with the approval of the Governor-in-Council, "be specified in the notice of sale.

"In the case of private sales, payment shall be by four equal annual "instalments, the first of which shall be one year after the date of the "deposit, and the others on the corresponding date in each of the next "succeeding years.

"To encourage the cultivation of economic plants, the final payment "will be returned to a certain number of purchasers of Crown lands "under these regulations, who are able to show good progress in this "direction, in the fourth year after the date of the deposit. Plants "may be obtained [from the Botanical Station] free of charge."

December 23.—The morning was spent at the Botanical Station. A plan was furnished by the Colonial Engineer, and on this various suggestions were entered for completing the planting up of the land. It was arranged that the plots at the Station should be numbered according to the plan, and that the progress reports should refer particularly to the operations carried on upon each one. The best position for the office, nurseries, and seed sheds was considered to be the land to the south-east, where at one time it was intended to have a lawn tennis ground. This land appeared to me to be unsuitable for that purpose, as it would not be likely to carry a good turf; and besides, if the small area available at this Station for the experimental cultivation of economic plants is taken into consideration, it is not desirable to reduce it still further by devoting a portion of it to a lawn tennis ground. If the additional land adjoining the present Station were acquired by Government, the matter might then very well come under consideration.

As the Christmas holidays were likely to prevent my being able to make many other satisfactory excursions into the interior of St. Lucia, it was arranged, with the approval of the Administrator, that an effort should be made the next day to visit the Soufriere district and send a sloop round to pick me up at Vieux Fort and cross over to St. Vincent. A sloop was kindly engaged for me by Mr. Chastanet, and it left with my baggage at 6 o'clock.

December 24.—I was up this morning at 4.30, and rode down to take the coasting steamer, leaving Castries at 6 o'clock for Soufriere. I arrived at the latter place soon after 8 o'clock. Along the coast there were numerous valleys extending inland, in which there were cultivations of sugar-cane and cocoa-nuts. The ridges, especially in the Canaries district, were all clothed with forests down to the sea. Mr. Jules Du Boulay kindly assisted me to hire a horse and accompanied me to the Soufriere. Afterwards we visited some cacao cultivation. Mr. Dix, the Resident Magistrate, was at Castries, and I therefore lost the opportunity of meeting him. A good deal of cacao, fruit, spices, and ground provisions is being grown here by peasant proprietors. The soil in some localities is very rich and yields large crops. Mr. Dix is himself a very intelligent and successful planter, and his example is very beneficial in regard to the development of small industries in the district. After parting with Mr. Du Boulay I rode in the direction of Choiseul through small clearings in the hilly parts of the island. The majestic peaks of the Pitons were almost everywhere in view, forming well defined landmarks to the westward. One of my objects in traversing this district was to meet Mr. Eugene Meynier, whose name had been mentioned to me as one of the most successful cultivators in this part of the island. Mr. Meynier was at home, and he received me very kindly. He was the first to export vegetable musk seeds (*Hibiscus Abelmoschus*) from St. Lucia. He received about 10*l*. per bag for it, but the value now is considerably reduced; it sometimes fetches only 3*l*. per bag. There was a small but interesting cacao estate just coming into bearing. An avenue of palms and ornamental plants led to the house, and, what is seldom seen in St. Lucia, clean and well kept pastures for cattle and horses. Mr. Meynier was able to show some excellent black pepper plants in fruit, pine-apples, very heavy bearing orange trees (St. Michael and Tangerine), sapodilla, and excellent vegetables. A few score industrious and intelligent men like Mr. Meynier would be a great boon to St. Lucia, where horticultural methods in regard to the cultivation of plants are almost unknown. Mr. Meynier some time ago was very successful in growing and curing tobacco. At the suggestion of Sir William Robinson, then Governor of the Windward Islands, small grants in aid were offered, and the industry made progress in various parts of the island. The grants were, however, withdrawn before the industry was established, and since 1884 nothing has been done in it. If a Cuban tobacco-grower could be induced to settle at St. Lucia and teach the people how to cure their tobacco, there is every hope that the industry would become permanent. There are excellent soils in St. Lucia, and the climate, especially in the southern districts, would appear to be well suited to produce tobacco of good quality.

I regained the coast road near Mr. Lloyd's sugar estate. After a slight rest here I started for the village of Laborie, and ultimately reached Vieux Fort about 6 o'clock. The sloop "Langeliere" arrived about 11 o'clock, and at midnight I embarked for St. Vincent.

A copy of the following report on the St. Lucia Botanical Station, dated 22nd December 1890, was presented to the Administrator :—

The Botanical station at St. Lucia has been established on land reclaimed to the north-east of the town of Castries. It will consist eventually of five and a half acres, but at present only about four acres are in a sufficiently complete state for being planted out. It is distant about half a mile from the landing place at Castries, and easily accessible to the inhabitants.

As the site of the station consisted of a swamp, considerable time has been occupied in filling it up and laying out the land. Apart from the advantages likely to be derived from the Garden itself, the elimination of a dangerous swamp in close proximity to the town of Castries is a public benefit. There is a further small portion of swamp on land adjoining the Botanical Station. This might be acquired and filled up.

If, however, the owner of the swamp, who is also owner of the land between the Darling and Chaussée Roads to the westward, could be induced to sell the whole of it, estimated at 7 acres, for a reasonable sum, it would be well to acquire it. The Botanical Station land would then consist of about 12½ acres, and it would form a very convenient and suitable site for nearly all the operations likely to be undertaken there. A sketch of the Botanical Station land as at present existing and of the land that may be acquired in the future is submitted.

The general plan of the Botanical Station is so far satisfactory. The roads, paths, and drains are suitable for the purpose in view, and should be completed without delay. The drains in every case require to be paved with suitable stone and faced with cement, so as to be easily flushed or swept out. The banks could then be covered with grass and masked with plants of a suitable character. The existence of drains with soft yielding slopes and unpaved water-ways is unsightly and unwholesome, and under the circumstances which obtain here in every way undesirable.

No permanent supply of water is laid on to the ground. Fortunately there is a copious and apparently a regular rainfall, and there has not been, as yet, any serious inconvenience arising from want of water. It would be desirable, however, to have a reserve of water in tanks or cisterns; or to lay pipes connecting with the Castries reservoir as soon as possible.

The Curator lives in a small cottage on a hill close to the station. This arrangement ensures a healthy locality for a residence, and keeps the Curator in touch with his charge.

The buildings necessary for the station should consist of a small office, a seed shed, tool shed, potting shed, and, later on, a small house for a watchman. There is a suitable site for these on what was intended at one time for a lawn tennis ground. The land is too poor for this purpose, and may very well be utilised for offices and sheds. If it is found desirable to lay out a lawn tennis ground at the station, and on this I express no opinion at present, such a ground might be selected near the Darling Road, and away from the ornamental and more cultivated portions of the station.

Before the land newly reclaimed is permanently laid out, nearly every portion of it will require to be covered with a layer, about 12 inches thick, of loamy soil, suitable for the growth of delicate plants. The present soil is suitable as a sub-soil, but it will not fully answer the purpose of a surface soil. Efforts should be made to obtain soil somewhere in the neighbourhood and cart it in before the walks and paths are permanently laid down. Some soil might be obtained from the adjoining land, but more will be required than is likely to be available from this source.

Some complaint has been made that the work of planting permanent trees has not been carried out so expeditiously as could be wished. There are some grounds for this complaint. The Curator should now proceed systematically with the work and furnish a weekly report showing exactly what is being done by him in this respect. The operations requiring immediate attention are as follows:—

a. Land recently reclaimed should be planted in maize, guinea corn, sweet potatoes, peas, beans, bananas, and other early maturing crops so as to bring it into a suitable condition for regular cultural operations.

b. Land suitable for the purpose should be marked out and planted with type specimens, properly named, of all the economic plants obtainable in the island. One or two plants of each would be quite sufficient.

c. Suitable plots should be selected for the experimental culture of cotton, tobacco, pine-apples, grapes, figs, cacao, spices (black pepper, vanilla, cardamoms, &c., &c.), and any other subjects likely to be suited to the circumstances of St. Lucia.

An important function of the Botanical Station is to teach the people of St. Lucia how to cultivate plants, and obtain the best results from their lands.

The Curator should do all that is possible to teach and train those with whom he comes in contact, and be always ready by precept and example to disseminate good horticultural methods among the people.

There should be some system organised for training intelligent boys at the Botanical Station to fit them for becoming gardeners, and have charge of plantations. The Curator might start with two or three at first, and have them apprenticed for two or three years. The pay should be small, and the boys encouraged to fit themselves for positions of trust where they would assist in the development of local industries.

The Rules for the Protection and Government of the Botanical Station recently adopted appear to be suitable, and are likely to be effective. [*See* Appendix A.]

ST. VINCENT.

St. Vincent lies about 30 miles southerly of St. Lucia and 100 miles westerly of Barbados. It contains 133 square miles, and a population of about 48,000. The whole island is of volcanic origin. The last eruption of the St. Vincent volcano (now known as the Soufriere) took place as late as 1812. This is situated at the northern extremity of the island, close to Morne à Garou, and rises about 3,000 feet above the level of the sea. A central ridge of mountains extends from north to south, and from this numerous spurs spread on each side, running down to the sea. The mountain slopes are less steep than at St. Lucia, and on the windward side, especially, there are easy gentle slopes well suited for sugar-cane cultivation. At present only about one-sixth of the surface of the island is under permanent cultivation. Large tracts of mountain lands, belonging to the Crown, are capable of growing cacao, coffee, and all kinds of tropical fruits and vegetables. These lands are now in course of being carefully surveyed. The climate of St. Vincent is comparatively cool and healthy. It is well watered by numerous streams, and the soil is fertile. Bequia, one of the group forming the Grenadines, under the Government of St. Vincent, is distant about 9 miles, and thinly populated by fishermen and a few peasants cultivating provision grounds and raising small stock. The chief productions of St. Vincent are sugar, rum, cocoa, arrowroot, spices, a very small quantity of coffee, cassava, honey, beeswax, oils, gums, tanning substances, medicinal plants, fibrous substances, and excellent timbers. St. Vincent very much resembles Dominica in its characteristic vegetation, and, like Dominica also, it possesses wonderful capabilities which have hitherto received little or no attention. The energies of the people have been almost entirely devoted to the production of sugar and arrowroot, and both these industries have of late years become more or less depressed. A good deal of the communication between Kingstown and the outlying islands and districts takes place by boats and small schooners. These are managed with great skill, and although the sea is often rough, especially in coming from Bequia, accidents are not of frequent occurence. The internal communication is by roads and bridle paths. The latter will require to be gradually extended to the rich lands in the interior.

December 25.—I arrived in the schooner from St. Lucia at Kingstown, the chief port of St. Vincent, on Christmas morning at 9 o'clock. I was kindly received by His Honour Captain Maling, the Administrator, at Government House. In the course of the afternoon we had a walk through the land set apart for the Botanical Station, which is situated immediately below and adjoining the Government House garden.

December 26.—This morning was spent at the Botanical Station with the Curator. The station occupies a portion of the old Botanical Garden of St. Vincent, established in 1764, but discontinued about 1830. A very interesting account of this garden, illustrated by coloured plates, is given by the Rev. Lansdown Guilding (Glasgow, 1825). This was dedicated to the late Sir W. J. Hooker, the Director of Kew. The St. Vincent Garden was in charge of Dr. Young, who, in 1772, received a gold medal from the Society of Arts "in recognition of the "flourishing state of the garden." Captain Bligh deposited 300 of the bread-fruit plants, brought by him from Tahiti, at St. Vincent, and a little later nutmeg, cinnamon, and cloves were introduced. Some of the mango and cinnamon plants which Lord Rodney took from a French man-of-war in 1792 were also sent to St. Vincent. Dr. Young was succeeded by Mr. Lochead, and, on the death of the latter, Mr. Caley was appointed Superintendent. Soon after this the War Office, under whose control the garden was maintained, discontinued the vote, and issued orders that any plants that could be moved should be sent to Trinidad. Since that time the land has remained in possession of the Government, but little has been done to it except to keep it fenced and gather any crops of nutmegs that might be produced on the trees still remaining there. Most of these trees were uprooted during the hurricane of 1886. The present attempt to revive botanical effort at St. Vincent is due to his Excellency the Honourable Sir Walter Hely-Hutchinson, K.C.M.G. The land has retained its fertility, and numerous interesting trees still remain upon it. The Governor-in-Chief states that "it might be of the greatest use, not merely to the agricul-"tural interests of the island, but for the promotion of the general "interests of tropical agriculture and the extension of botanical know-"ledge." Mr. Henry Powell (formerly of Kew) was appointed Curator of the Botanical Station in April 1890. At the time of my visit a portion of the land had been cleared, nurseries and seed-sheds had been started, and experimental plots of sisal hemp, cotton, pine-apples, and other plants established. In conjunction with Captain Maling and the Curator a plan was prepared for laying out the land. The direction of the roads and drains and the shelter belts necessary for protecting the Station from north winds was defined. The site proposed for the offices and plant-houses was then examined, as also the position selected for the Curator's house. In all these and kindred matters Captain Maling took a deep personal interest, and I have little doubt the station will make great progress under his superintendence.

December 27.—The morning was spent at the Botanical Station. In the afternoon at 4 o'clock I gave an address at the Court House on the objects sought by the establishment of a Botanical Station, and the special industries likely to be successfully pursued in the island. The chair was taken by the Administrator. Information was given in regard to the borer (*Chilo* (*Diatræa*) *saccharalis*) which had lately attacked the sugar-cane, and suggestions offered for dealing with it. This borer, which is the larva of a small moth, was first noticed at St. Vincent in 1828, and it is now found almost everywhere in the tropics. It has injured sugar-cane at Jamaica (in 1841); at Mauritius (in 1856); at Louisiana (in 1857); at British Guiana (in 1879); and latterly it has been found in Queensland and in various parts of India. The planters of St. Vincent were advised to take prompt measures in dealing with the pest, and if the recommendations then made are fully carried out there is every reason to believe that the injurious effects of the borer can be almost entirely kept in check.

The circumstances of the arrowroot industry were also discussed. This has for a long period been a staple industry of the island. Latterly, however, St. Vincent arrowroot has fallen so low in price that it has hardly paid to export it. At the request of the Governor an inquiry was lately made at Kew into the cause of this. It is probable that in some cases the soil has been exhausted, and in others that the process of manufacture has not been maintained at so high a standard as formerly. Possibly both these circumstances have been at work at one time. In any case, a firm of city merchants to whom Kew applied for information on the subject, expressed the opinion "that during the last few years " there has been a considerable falling off in the quality and appearance " of St. Vincent arrowroots, so much so that they have now reached the " low level of inferior brands. In other words they have lost their " reputation."

This opinion was confirmed by other merchants. It was suggested that systematic effort should be made to bring about a more satisfactory state of things, and that the planters should energetically grapple with the situation and realise that the matter was practically within their own control. A series of St. Vincent soils in which arrowroot had been grown, analysed by Mr. John Hughes, F.I.C., showed that they were " singularly poor in nitrogen, phosphoric acid, and potash; further, " that they were of a very siliceous character, and possessed little " retentive properties." A change of soil or the addition of suitable manures is evidently called for. In the process of manufacture there were numerous improvements capable of being introduced, while the nature and purity of the water and other circumstances also bore directly upon the subject. A fungoid disease attacking the plants had been noticed on one estate, but this is not believed to have had any injurious influence on the general quality of St. Vincent arrowroot.

December 28.—At the invitation of Mr. Duncan MacDonald I left Kingstown for Wallilabo, an estate on the west coast. We travelled by boat, and arrived at our destination about 11 o'clock. After lunch we rode into the interior, visiting small cultivations of cacao and coffee in course of being established by Mr. MacDonald. In good soil and sheltered situation the plants were doing very well. An excellent view was obtained of the interior valleys. The mountain slopes were being extensively cleared for provision grounds by the negroes, but little or no permanent cultivation was seen. In the afternoon Mr. MacDonald was good enough to show me the process of arrowroot manufacture. Nothing could be better done, and I was not surprised to find that his arrowroot was of the best quality. It is evident that if all the planters cultivated highly and paid the same careful attention to the manufacture, St. Vincent arrowroot would soon regain its position in the markets of the world.

December 29.—I left Wallilabo at 10 o'clock for Chateaubelair. Here I met Mr. Herbert H. Smith, the Collector in Zoology, engaged by Mr. DuCane Godman, F.R.S., in furtherance of the work of the West Indian (Natural History) Exploration Committee. My object was to visit the Richmond valley, a rich tract of country lately explored at the foot of the spurs of Morne à Garou. Mr. Herbert Smith, who knew the valley well and had taken a deep interest in it, was good enough to accompany me and make all the arrangements for the journey. After breakfast we rode through the Golden Grove sugar estate and up the valley leading to the high woods through Petit Bordell. We left the horses near the crest of a ridge, and then made our way along this for some distance until we overlooked a deep valley with Morne à Garon rising in the distance due north. We descended by a steep path to the bottom of this valley, and after following the course of a river for a short distance we struck across the country in a northerly direction until we struck a larger river flowing to the left. We now found ourselves at the bottom of the Richmond valley, and camped for the night at a sheltered spot at an elevation of 1,000 feet close to the river. According to Mr. Herbert Smith the valley extended inland from this point for four or five miles. It had an average breadth of about three to four miles. Altogether it was estimated that there were between 8,000 and 10,000 acres of rich forest in this district, and most of it was suitable for cultivation. The elevation would range from 1,000 feet to 2,500 feet. The land is broken up into numerous valleys and ravines bounded by somewhat sharp rocky ridges. There are numerous streams of excellent water. The soil that came under my observation was of a rich loamy character on a substratum of clay and broken rock. There was very fine timber growing everywhere. We camped under the shelter of fine clean-stemmed Gommier trees, some of which were three to four feet in diameter. In a direct line the distance from the coast would not be more than eight to ten miles. So far no cultivation had been attempted in any part of the valley. The general character of the vegetation indicated a rich soil, plenty of moisture, and sheltered conditions.

December 30.—Leaving Mr. Herbert Smith to continue a journey he had planned across the island I returned to Chateaubelair with a negro guide, following the tortuous and rocky course of the river. This had to be crossed about six times. In leaping from one boulder to another my foot slipped and a heavy stone fell on my toe and crushed it. The rest of the journey was completed with some difficulty. I arrived at a small clearing called King's Pleasure about 10 o'clock, and there was met by Mrs. Herbert Smith and a servant with a pony. After breakfast I left Chateaubelair in a boat for Kingstown, where I arrived at 3.40. Although suffering a good deal with my foot I kept an engagement to give another address at the Court House at 4 o'clock, for which a large number of planters and small negro proprietors had come in from the country. In this address I drew attention to the extensive clearing of rich forest lands that was taking place in the interior of the island merely to grow a few crops of yams and provisions. These lands were exhausted by successive crops, and then abandoned for fresh land. This system was characterised as a most injurious and wasteful one, and demanding the earnest attention not only of the owners of such land, but of all interested in the welfare of the island. Suggestions were made respecting the permanent retention of such lands in a state of fertility, and the plants likely to be successfully cultivated upon them.

The prospects of industries in coffee, cacao, fruit-growing, spices, fibres, tobacco, cocoa-nuts were discussed, and hints given respecting numerous forest products such as timber, gums, and tanning substances capable of being utilised at a small cost.

December 31.—As I was laid up with my foot I discussed with the Curator at Government House various subjects connected with the Botanical Station, and I prepared a short report upon it. A series of papers relating to the survey and sale of Crown lands was received from the Administrator. I was glad to notice that in the Regulations passed in Executive Council on the 4th June 1887 it is stipulated that "purchasers [of Crown lands] under these Regulations shall bind themselves to clear and plant the land with such trees, whether cocoa, nutmegs, coffee, &c., or other products as may be approved in each case by the Governor, subject to the under-mentioned conditions; namely—

"Within two years, one-fourth of the area purchased;
"Within four years, one-half; and
"Within six years, three-fourths.

"If any purchaser under contract fails to pay any part of the purchase money, or if any such purchaser having obtained a grant, fails to observe the conditions for planting the land as above specified, the contract, or grant, in either case, may be rescinded or revoked by the Governor. Notice in the *Government Gazette* shall be conclusive proof of the rescission of any contract."

Such provisions as these in regard to establishing crown lands in permanent cultivation should, I believe, be gradually extended to every West Indian island, and if the conditions are enforced with due regard to the special circumstances of the land and its capabilities for maintaining permanent crops the cultivators themselves as well as the community generally would greatly profit by them. In supplying seeds and plants for permanent industries the Botanical Stations now established in the islands would be able to give useful assistance. The Curators would also be in a position to afford information and assist the cultivators in deciding upon the selection of subjects best suited to the soil and climate.

In the evening I embarked on board the sloop "Water Witch" for Grenada.

The following is a summary of the Report prepared on the Botanical Station at St. Vincent:—

The Botanical Station at St. Vincent is in course of being established on a portion (about 8 acres) of the old Botanic Garden of the Colony abandoned about 60 years ago. The land lies in a cool, fertile valley below Government House. It is within easy reach of Kingstown, the capital, and about one mile distant from the landing place. Owing to the prevalence of strong winds the area selected for cultivation will require to be well sheltered. Shelter belts of Galba (*Calophyllum Calaba*) have been recommended to be planted across the trend of the valley. Water is required to be laid on to the plant-houses and nurseries. The boundary fences are in good order. The plan of the roads and the system of drains have been carefully worked out. The Curator has already made arrangements for planting out specimen plants of an economic character. Some of these are already doing well. The nurseries are in good working order, and plants are regularly distributed to those desirous of trying new cultures. A house for the Curator is in course of being built on the land. The plan, prepared by Mr. Osment, Colonial Engineer, might very well be adopted as a model of what is suitable for the residence of a Curator of a Botanical Station in the West Indies. The Botanical Station is under the personal direction of the Administrator. A committee of local gentlemen has been appointed to advise and assist the Administrator, but the functions of this committee are strictly defined, and do not include the control of the action of the Curator. A set of rules has been drawn up for the government and regulation of the station similar to those in force at Grenada and St. Lucia. The present Administrator, Captain Maling, takes a very deep interest in the work of the Station. The Curator, Mr. Powell, is devoted to his duties, and has already created a favourable impression by the energy and zeal with which he has entered upon the work of laying out the garden, and the deep interest he has taken in local industries.

GRENADA.

Grenada is mountainous and very picturesque. It contains 133 square miles (about half the size of Middlesex), and a population of about 50,000. On the leeward side bold headlands, with intervening valleys and ravines, come down to the sea. On the windward side the slopes are easier, with plains extending in a parallel direction north and south. There are numerous springs and streams and two crater lakes, one, the Grand Étang, at an elevation of 1,740 feet, and the other, Lake Antoine, near the north-eastern coast. The conformation of the country is well suited for the purposes of agriculture; there is a regular and copious rainfall, and the soil is fertile. The latter has been formed by the disintegration of volcanic rocks, and varies from a loose friable loam to a reddish strong clay. This latter is found principally in the mountainous parts of the island, and where of a marly character on a substratum of broken rock, it yields large crops of cacao and nutmegs. Grenada is a particularly healthy island. The heat is tempered by regular trade winds, and hurricanes are hardly known. The roads in Grenada have of late years been much improved. In the mountain districts they exist chiefly as bridle paths, but they are for the most part well graded and well drained. A regular coasting service is maintained between St. George and the other ports.

St. George, the capital, has an excellent and well protected harbour and bay. The town is built on a hill projecting into the sea, between the harbour and the bay, and occupies a commanding position. It has much improved of late years, and it is well supplied with water. There are several other towns along the coast, such as Gouave, Sauteurs, and Grenville. The latter is on the windward side, and possesses a good harbour, with, however, a very narrow and difficult entrance.

Carriacou and Cannouan are the largest of the Grenadines under the Government of Grenada. These possess an arid climate and rather poor soil, but at one time, before they were deforested and the soil exhausted, they yielded large crops, both of sugar and other produce.

In the olden days Grenada was a prosperous sugar colony. At present there are very few sugar estates, and the whole character of the cultivation have been changed by the substitution of cacao. The exports of this have reached 55,393 cwts., of the value of 166,178*l*. Spices, such as nutmegs, mace, cloves, and cinnamon are largely grown; the exports of these amounted in 1889 to 1,460 cwts., of the value of 10,220*l*. Cotton and ground-nuts are produced in the Grenadines. The exports of these are:—Cotton, 3,357 cwts., of 6,714*l*.; and ground-nuts, 347 cwts., of the value of 260*l*. Tropical fruits and vegetables are abundant and cheap. The food resources of the negroes consist of yams, sweet potatoes, kush-kush, pigeon-peas, plantains, Indian corn, cassava, bread fruit.

January 1.—I arrived, in the "Water Witch," off St. George's, Grenada, about 1 o'clock and landed at 2. After a short conference with the Acting-Colonial Secretary (Mr. Drayton), I rode up to Government House and met the Governor-in-Chief. Later in the afternoon we visited the Botanical Garden. I was much pleased with the luxuriant appearance and the growth made by the plants since 1886.

January 2 to January 4.—Under the advice of Dr. Orgias I rested my foot for a few days. In the meantime I was able to discuss numerous subjects of a botanical character relating to the Windward Islands with the Governor-in-Chief. The newly appointed Curator of the Botanical Garden, Mr. George W. Smith, brought up a plan of operations for the coming year. I arranged with him in regard to suitable subjects for the monthly *Bulletin*, and a selection of plants for the trial plots to be established in aid of local industries.

January 5.—Visited the Botanical Garden. Went carefully over the land and sketched the position of drains, paths, and water pipes necessary for a proper working of the establishment. In the afternoon engaged with correspondence.

January 6.—Again visited the Botanical Garden and selected the position of various experimental or trial plots. In the afternoon left with Mr. R. T. Wright, the Chief of Police, for the parish of St. David. Rode along the Windsor Road to St. David's Court House, and then to Hampstead, the residence of Dr. Wells, who had kindly offered to receive me for the night. Dr. Wells has a most interesting estate at a moderate elevation above the sea, with nutmeg, clove, cinnamon, cacao, and other plants well established. The situation was under the shelter of a large hill covered with virgin forest, evidently admirably adapted for growing spices. Some of the nutmeg trees were the oldest and finest in the island. The pimento or allspice of Grenada is evidently *Pimenta acris*, the bay-rum tree, and not *Pimenta officinalis*, the true allspice of Jamaica. The parish of St. David is for the most part occupied by small settlers, who grow a little sugar-cane, some cacao, fruits, and vegetables. The soil is a rich red clay. One or two large sugar estates, the remnants only of the old sugar industry of the island, survive in the alluvial valleys near the sea coast.

January 7.—I left Hampstead about 9 o'clock, and rode through Grand Bacolet (a sugar estate belonging to Mr. Lamothe), and through Tuileries (another sugar estate belonging to Mr. Batt). These are on the windward slopes of the island, facing east. Cacao is grown in the valleys running inland. About 4 o'clock I reached Bellevue (St. Andrew's), a nutmeg and cacao estate belonging to the Hon. H. R. Schooles. This is at an elevation of 1,100 feet. There were here some very large and productive nutmeg trees, from 30 to 40 years old. A number of these trees, covering about 10 acres of land, have been known to yield annual crops of nutmegs of the gross value of about 1,000*l.* sterling. This is doubtless the most valuable plot of cultivated land in the West Indies. The yield is, of course, phenomenal. It has taken about 30 years to bring it about, and the special circumstances of soil, climate, and aspect found here may possibly not be met with anywhere else in the tropics. Amongst other plants seen here were *Tacsonia sanguinea*, an attractive native passion flower; a fine specimen of *Sabal Blackburniana*; the Spanish nutmeg (*Myristica surinamensis*); and crowning the top of the hill close to the house were two fine plants of the cabbage palm (*Oreodoxa oleracea*), about 130 feet high.

January 8.—In company with Mr. W. R. Elliott, the manager of the estate, I visited the higher valleys above the house, where cacao, nutmegs, and coffee were in course of being planted. The localities for these were rich slopes well sheltered by spurs running down from the central range of mountains. In the afternoon I rode to Grenville, a thriving, busy town on the windward side. Afterwards I went to Boulogne estate, where I was hospitably received by Colonel Duncan, who had lately come out to visit his Grenada estates. Colonel Duncan is an enterprising proprietor, and he has established several cacao and nutmeg estates. His example has stimulated the cultivation of all kinds of spices and other plants in the island. Grenada is destined to become more widely known for its spices than anything else. It produces already more than 1,400 cwts. of nutmegs, mace, and cloves, of the annual value of 10,220*l*. In a few years, when the young trees now growing come into bearing, it is anticipated that the exports of spices will be more than quadrupled.

January 9.—I had the pleasure, in company with Colonel Duncan, of visiting the cacao fields at Boulogne and the excellent cacao house (boucan) for fermenting and curing the produce. A method for drying cacao by means of hot-water pipes, devised by Mr. Messervy, the Director of Public Works, was in course of being fitted to the existing cacao house. This was of so simple a character that it could easily be adapted to cacao houses of any size or character. During the prevalence of wet weather it would be likely to be most effective. A model of this apparatus was shown in working order at the Jamaica Exhibition. As showing the improvement capable of being effected in regard to a single estate by Colonel Duncan, it may be mentioned that during my visit to the Boulogne Estate in 1886 the crop was about 180 bags (30,000 lbs.) of cacao. In 1890, owing to extended planting and improved cultivation, the crop had reached nearly 400 bags (68,000 lbs.) of cacao. Altogether in Grenada there are about 16,000 acres under cultivation in cacao, and the exports in 1889 were 6,203,973 lbs., of the value of 166,178*l*. In 1875 the exports were 3,137,360 lbs., and in 1865 only 1,263,743 lbs. There are several large and well managed estates, such as Plaisance, Tufton Hall, Duggaldstone, Annandale; but Grenada is peculiar in possessing numerous negro proprietors, who cultivate small estates in cacao, and add considerably to the total of the exports. After lunch I left Boulogne, and rode through Mount Horne, Force, Columbia, Balthazar, and Chantilly to Colonel Duncan's nutmeg estate at Belvidere, where I met the Hon. F. Gurney, the manager, and spent a most interesting afternoon. This estate, situated in a depression in the centre of the island, will eventually contain about 250 to 300 acres of nutmeg trees, all of which are in an excellent state of cultivation and a large number bearing heavy crops. Nowhere else in the New World has the nutmeg tree found so congenial a home. In the evening we reached Mount Felix, on the leeward slope, a cacao estate, where nutmeg trees are also growing most luxuriantly. A large tree of *Cinchona succirubra*, the red bark cinchona, about 35 feet high, was growing just below the house. This and some others were received from me while in charge of the Jamaica Botanical Gardens in 1884.

January 10.—The morning was spent in making observations and collecting specimens of the Cacao beetle, determined by Mr. R. McLachlan, F.R.S., as *Steirastoma depressa*, L. This is a longicorn beetle which has been doing some harm on Grenada estates. It bores while in the grub state into the cacao trees, just below the bark, and when the burrow extends all round a stem or branch the trees are permanently injured. The beetle has probably been introduced from South America. It is a well known enemy of cacao trees in Surinam, and specimens were shown in the Surinam Court at the Jamaica Exhibition. I found both male and female beetles at Mount Felix on cacao trees. The females were busy laying their eggs.

Some Liberian coffee trees were in a very thriving condition, but in some cases they had been cut down to make room for nutmeg trees. Several plants of vanilla were growing on tall trees, and there were numerous clumps of Malabar and Ceylon cardamoms and Melegueta pepper. Besides these were some trees of Ceara rubber, tonquin bean, Arabian coffee, cloves, and cola nut. To quote the words of the manager, "the soil and climate of Grenada will grow everything," and to judge by the number of valuable plants flourishing at Mount Felix this would appear to be almost true. After a long day in this interesting portion of Grenada I had the pleasure of returning with Mr. Wright through Belvidere Estate, and after passing over the Grand Étang we took the main road to St. George's through Constantine, Snug Corner, and Tempé Valley. I arrived at Government House at 6.30 p.m.

January 12.—I gave an address in the Court House at 11 o'clock. The Governor-in-Chief, the Hon. Sir Walter Hely-Hutchinson, K.C.M.G., took the chair. A full report of this address was given in the *Grenada Chronicle* of January 17, 1891. The aims and objects of the Botanical Garden were first discussed, and a sketch given of the improvements likely to arise by its co-operation in fostering local industries. Attention was directed to the desirability of extending knowledge in regard to horticultural methods, and to training young men as gardeners and to take part in extending minor industries. In spite of the flourishing state of the cacao and spice industries in Grenada there were still nearly 57,000 acres of uncultivated land in the island. After allowing a suitable amount to be permanently kept in forest on the central ridges, at least 15,000 to 20,000 acres of land already cleared remained to be made productive. Plants for such lands were suggested and hints given for their successful treatment. The following industries were then briefly reviewed:—Sugar, cacao, nutmegs, cloves, cinnamon, vanilla, black pepper, cardamoms, oranges, bananas, pine-apples, grapes, mangoes, Arabian coffee, Liberian coffee, fibres, tobacco, cocoa-nuts, silk, cotton, and Gambier. An account was given of some of the insect and fungoid pests affecting cultivated plants in the island and directions given for dealing with them. By means of a large drawing of the cacao beetle kindly prepared by Lady Hely-Hutchinson and various specimens placed before the meeting, the life-history of this enemy of the cacao trees was sketched. It was pointed out that it was very easy to capture the beetles in the early morning, and if children were regularly and systematically employed to do this during one or two seasons there would soon be an end to them.

January 13 *to January* 15.—A visit was paid to the interior forests in the neighbourhood of the Grand Étang with Mr. R. V. Sherring, F.L.S., employed by the West India (Natural History) Exploration Committee to make collections of the flowering and cryptogamic plants of Grenada. Within a radius of two miles of the Rest House about 60 species of ferns were observed, and numerous small flowered orchids some of which were probably undescribed. Numerous palms were found crowning the ridges, and exceptionally fine mountain gommier or incense trees (*Dacryodes hexandra*). The results of the Botanical collections made in this and the other islands will be published from time to time. Already very valuable additional information has been obtained of the distribution of certain species, and many new ones have been described.

January 16.—I paid a final visit to the Botanical Garden this morning; and I had an opportunity of discussing the conclusions embodied in my official report with Mr. J. H. Hart, F.L.S., Superintendent of the Botanical Gardens at Trinidad. Mr. Hart supervises the Botanical Institutions in the Windward Islands, and he had come to Grenada to meet me. I was glad to find that a good foreman could be recommended by him for service under Mr. Smith. At 9 o'clock I embarked on board the R.M.S. Eden (Captain Smith) for Barbados and Jamaica. The Governor-in-Chief was also on board going on an official visit to St. Vincent. The following is my report on the Grenada Botanical Garden :—

This garden was started in 1886. It is situated about a mile due west of the town of St. George by road; but it may be reached by water from the wharf by a much shorter distance.

The site was selected on account of its proximity to the town, the richness of the soil, and shelter from prevailing winds. The land is bounded to the north by a somewhat steep slope of about 500 feet, at the top of which is Richmond Hill. The garden, in fact, occupies a hollow sheltered slope at the foot of this hill and faces the harbour (careenage). The site is in every respect well suited for the purpose of a Botanical Garden; and the rapid growth made during the last three or four years by the palms and trees in it fully bears out this view. The only serious drawbacks to the site as pointed out by me to the Garden Committee in 1886 were (1) the probable wash that would arise from water coming down the slopes; and (2) the absence of a permanent water supply. To remedy the first defect, I strongly urged that a large well-paved drain be constructed horizontally above the garden boundary to carry off all the water coming down from the Richmond Hill. I then recommended also that a series of contour-drains be made on the land itself, and that these be connected with three walled and paved drains passing down at the side of or through the garden grounds. Under a system of drains here indicated, constructed under the supervision of a surveyor and engineer, the garden land would have been efficiently drained, and no water whatever would have interfered with the garden paths or caused wash in any portion of it. Owing to various circumstances, which I need not discuss here, the arrangements for draining the land were never fully carried out. In consequence, considerable injury has been caused to the garden paths and beds, and the work so long delayed now remains to be dealt with in an efficient manner. I am glad to find that a vote of 120*l*. appears on this year's Estimates for this purpose. It is probable that a larger sum will be necessary to complete the whole work; but the amount already voted will go far to construct the most urgent of the drains required. It is hoped that provision will be made in next year's Estimates to complete the work. The supply of water to the garden is now in course of being laid down. The want of a continuous supply of water during the first three years' operations at the garden has been severely felt. In fact, I attribute to this the backward state of many of the operations connected with the garden work, as for some time the greater part of the small sum allowed for the establishment had to be expended in carrying water by hand to keep the plants alive. To render the present water supply more efficient it is necessary to furnish each stand-pipe, or many of them, with a small cement or iron tank into which the water-cans could easily be dipped and filled.

I may, however, mention that, in spite of the drawbacks which have hampered the proper establishment of this garden during the last five years, its present condition is by no means unsatisfactory. The original laying-out and planning of the garden devolved upon Mr. W. R. Elliott, who was first Curator, from March 1886 to 1889.

I must bear testimony to the good work done by this officer, often under disadvantageous and discouraging circumstances ; and the only permanent features of the garden of a satisfactory character which now remain are clearly traceable to Mr. Elliott's efforts. Some of the walks are rather steep, and a few beds and banks will require to be re-laid and re-made, but taking into account the rough nature of the land when taken over by Mr. Elliott in 1886, and the difficulties he had to contend with, I am of opinion that he took a judicious and practical view of the situation, and the main features of the garden as first laid out by him should be adopted in any future operations.

As regards cultural details and recommendations of a purely routine character, the reports prepared by Mr. Hart fully meet the circumstances of the case. The supervision exercised by Mr. Hart over this and the other Botanical establishments in the Windward group is calculated to render them more efficient than they would otherwise be, and I recommend that, in addition to Mr. Hart's annual visits, the Curators might be allowed to go to Trinidad from time to time in order to study the operations carried on there, and make a selection of seeds and plants for their several gardens.

Amongst the special matters now requiring attention at the Grenada Garden, are the erection of a seed shed for raising plants from seed, and the re-arrangement of the nursery beds. The present very unsightly potting shed may be converted into a tool-shed, potting shed, and a store-room for cases. The entrance to it should be masked by an arbour covered with creepers. The present office should have a rockery on the upper side of it, containing a selection of succulent plants, and the surroundings below and on the sides should be made as ornamental and as attractive as possible.

Mr. Hart has already dealt with the treatment of the footpaths. I would add that the drains crossing the footpaths should have earthenware or concrete pipes, and in no case should an open drain be allowed on the main footpaths. Further, a contour-drain should be constructed on the slopes about 4 feet above every horizontal footpath, and the slopes above and below the footpaths should be covered with grass, and meet the path (or drain if there be one) without any intervening space of broken soil. Some of the slopes constructed by Mr. Elliott are of this character. The system should be extended throughout the garden.

The plants already established in the garden are growing well, and they will soon give the place an attractive appearance. Many of the plants are common sorts, and scarcely ornamental enough for a Botanic Garden. This is a defect that can be gradually remedied. The collection of economic plants is somewhat small and should be increased. Scarcely any experimental work has, so far, been undertaken. Trial plots might be established, as soon as circumstances permit, with such plants as Egyptian cotton, tobacco, vanilla, cubebs, black pepper, Gambier, cloves, nutmegs, pine-apples, vines, and any others likely to be of use or interest to the island. It is not desirable to have numerous plots in operation at one time. The work should be distributed so as not to encroach too heavily on the garden vote, and at the same time be confined to subjects of practical interest to planters and others. This industrial side of the Botanic Garden work should not be lost sight of. It is one of the most important functions which the garden is intended to discharge, and if judiciously carried out, with suitable information published from time to time in the monthly *Bulletin*, it cannot fail to be widely and duly appreciated.

In addition to the collections of ornamental and economic plants the Curator should make a special effort to introduce into it as many native plants as possible for the instruction of visitors. The ferns of Grenada, for instance, are very interesting, and owing to the researches in course of being carried out under the auspices of the West India (Natural History) Exploration Committee, they are known to be very numerous and characteristic. The Curator might at once commence a fernery in a suitable spot, and all the native and other ferns should be correctly and distinctly labelled. The same course might be adopted with regard to the native orchids, the native medicinal plants, the most remarkable timber trees, and, indeed, of all noteworthy plants native of the island. Of the latter plants one or two specimens only would be necessary or desirable. At present the garden possesses few or no native plants. As these are often found in remote and inaccessible places, entirely beyond the reach of most of the inhabitants, it is impossible for them to be observed and studied unless they are cultivated in some central spot like the Botanical Garden. The Curator should receive permission to visit different parts of the island for the purpose of making collections as well as to meet planters and study the circumstances of local industries. I find that the number of people who visit the Grenada Garden at present is very small. Apparently the people have failed to be interested in the work of the garden, and the suggestions here made will, I believe, go far to remedy this defect.

As already stated, this garden was under the care of Mr. Elliott from 1886 to 1889. After his retirement it was temporarily placed under the control of a sub-foreman from the Trinidad Botanic Gardens. In 1890 Mr. Charles Murray, formerly of the Edinburgh Botanic Gardens, appointed Curator of the Botanic Station at Dominica, was transferred to Grenada. Mr. Murray proved unsuitable for the post, and he resigned the appointment in November last. The present Curator, Mr. G. W. Smith, has been appointed by the Governor on probation for six months. Mr. Smith has not received a regular training as a gardener, and in this respect he is placed at a disadvantage in regard to the more technical duties of the post. I have had numerous opportunities of meeting Mr. Smith at the Botanic Garden during the last fortnight, and have spent several hours with him discussing the details of garden work. I am of opinion that, as Mr. Smith is so thoroughly interested in his work, possesses a good knowledge of plants, and has made so good a reputation as a botanical collector in St. Vincent, he may prove an efficient Curator of the Grenada Garden. He is active and energetic, and evidently thoroughly accustomed to bear fatigue in a tropical climate. Under the circumstances of the case I recommend that Mr. Smith may be allowed to remain in charge of the garden. It is essential, however, that an efficient foreman, trained at the Jamaica or Trinidad establishment, be engaged to carry on the nursery and planting work and assist the Curator in training young lads as gardeners. It is unnecessary to explain more fully the desirability of training young lads at these Botanical Stations. The subject has already been dealt with in the reports on other Stations.

It would be of considerable advantage to Mr. Smith if he could at an early date spend some time at the Trinidad Botanic Gardens, and obtain a thorough insight into the details of the work of the propagating sheds and the nurseries at that establishment.

If the recommendations contained in this report are fully carried out, I have every hope that the Grenada Garden will enter upon a more successful career than heretofore, and that it will prove of lasting benefit to the community. The present Governor-in-Chief takes a deep personal interest in the Institution, and that in itself is an important element in regard to securing greater efficiency in administration and in attracting public attention to the work carried on in connexion with it.

TRINIDAD.

It was intended that I should pay a visit to Trinidad during my mission, and I had made arrangements to do so. I had also received a very kind invitation from His Excellency Sir William Robinson, K.C.M.G., whose energetic efforts in behalf of cultural industries in the West Indies have produced such good results. I had looked forward with great interest to renew my acquaintance with the splendid island in which Sir William Robinson had lately developed many new industries, and to observe the progress made in regard to the staple industries ot sugar and cacao. A very successful and interesting industrial exhibition had just been held at Port of Spain, and I had also been asked to meet the members of the Central Agricultural Board.

Owing, however, to the time lost while I was laid up at Grenada, and the absence of a convenient means for crossing over to Trinidad between the mails, I was compelled, much to my regret, to give up my intention to visit the island. One of the objects I had in view in going to Trinidad was to confer with Mr. Hart in regard to the supervision of the Botanical Stations in the Windward Islands. I was, however, able to carry out this part of the arrangement by the courtesy of Sir William Robinson, who kindly allowed Mr. Hart to meet me at Grenada.

BARBADOS.

On the voyage north the "Eden" touched at St. Vincent about 5 o'clock. The Administrator, Captain Maling, came on board to receive the Governor-in-Chief, and he brought with him six Caribs, who were going to show their special method of making baskets at the industrial village in connexion with the Jamaica Exhibition. I undertook to look after the men during the voyage. In taking leave of Sir Walter Hely-Hutchinson at St. Vincent, I expressed to him my warm thanks for the personal kindness and the hospitality I had received from him at Grenada. It was with sincere pleasure I had discussed with him the numerous and enlightened measures he has in hand for the development of the resources of the Windward Islands.

January 17.—I arrived at Barbados at 6 a.m., and in accordance with an arrangement previously made with Mr. J. R. Bovell, Superintendent of the Botanical Station at Dodd, I visited that institution. The station is attached to the boys' reformatory school, and the labour of the boys is utilised to cultivate about 90 acres of land chiefly in sugar-canes. The idea of establishing a Botanical Station here is due to Sir William Robinson when he was Governor of the Windward Islands in 1886. Numerous varieties of canes were obtained from Jamaica and elsewhere, and in conjunction with Professor Harrison, Mr. Bovell, the Superintendent, undertook and carried out a very valuable series of cultural experiments to determine the best varieties of canes suitable for the circumstances of Barbados. After this the scope of the experiments was enlarged, and the effect of artificial and other manures on the growth and yield of canes was carefully followed. The results of these investigations were published in annual reports prepared by Professor Harrison and Mr. Bovell. In 1887–88 there were noticed in the cane fields at Dodd grass-like growths which were supposed to be seedling sugar-canes. The first information respecting this discovery (or rather rediscovery, for similar growths had been noticed before at Barbados) was published in the *Kew Bulletin* for December 1888. Both botanists and sugar planters had hitherto sought in vain for seeds of the cultivated varieties of sugar-cane. The subject was closely followed in subsequent years, and the fact was ultimately established that under certain conditions some varieties of sugar-canes still retain the power of producing fertile seed. A description of the flower and fruit of the sugar-cane, with plate, is given in the *Journal* of Linnean Society, vol. xxviii. (Botany), p. 197, pl. 33. Observations on the same subject, which proved afterwards to be earlier than those made at Barbados, as regards a description and drawings of the seed, were published by Dr. Benecke at Java in 1889.

The observations and investigations carried on at the Barbados Botanical Station are generally acknowledged to be of the highest value to the staple industry of the island. The facts so far obtained show that a good deal more is possible to be done to improve the yield of canes; and in spite of the great importance of the sugar industry to the West Indian Islands, it is surprising that no systematic efforts have hitherto been made to establish experimental stations properly equipped for the special purpose of doing for the sugar-cane what has been so successfully accomplished in European countries in regard to the beet. It is true that something has been done in this direction on private estates at Trinidad and Demerara, but what is evidently required now is an experimental station devoted to scientific agricultural research controlled by competent men, and acting as the training school for the planters of the future.

Besides the experiments in sugar-cane an effort has been made at the Dodd Botanical Station to cultivate other plants, especially species of *Agave*, *Furcræa*, *Sansevieria*, *Boehmeria* for fibre purposes. The land is, however, of too clayey a character for such plants, and also too much exposed to strong and dry winds. While it has answered very well up to a certain point for useful experiments in regard to sugar-cane, the land at Dodd is quite unsuitable for the cultivation of other plants. The wind is most injurious to them, and during certain seasons of the year there is little or no water available for purposes of cultivation. It would be of considerable advantage in the interests of the sugar industry, as well as of others, to possess an experimental station in another part of the island. A petition of the Barbados Agricultural Society and Reid School of Practical Chemistry has been presented to the Governor, asking "that a Bill be sent down "to the Legislature appropriating a sum of money for the purpose of "establishing on the highlands in the 'ratooning' district of the island "a second botanical and experimental station similar to that already "existing at Dodd." If such a second station were established, it is possible that land might be found well suited for the cultivation of many other plants likely to prove of great value to Barbados. The island is now so entirely dependent on sugar, that it is very desirable to encourage as far as possible any measure calculated to improve and establish it. It is also equally important to support it by other and subsidiary industries. There are several thousand acres of waste land in Barbados where a fibre industry might be successfully established, and there are also other lands where plants yielding tanning barks might be cultivated. None of these can be experimentally tried under favourable circumstances at Dodd owing to the unsuitability of the soil and the exposed character of the locality.

January 19.—A very interesting day was spent visiting estates on the western side of Barbados. In the evening I embarked on board the R.M.S. "Medway" for Jamaica.

JAMAICA.

A good deal of interest is attached to Jamaica just now. After a very long period of stagnation it is believed that it has eventually entered upon a condition of comparative prosperity. It has a large surplus revenue, the land is fast increasing in value, and the people have developed numerous resources which a few years ago were little thought of. The fruit industry of Jamaica (chiefly in bananas and oranges) is probably now the most important of any in the tropics. In 1875 this was of the estimated value of 15,000*l.*; in 1884 it had increased to 274,000*l.*; while in 1889 it had reached the total value of 324,000*l.* During 1889 the value of the sugar exported was 244,000*l.*, and of the rum 137,000*l.* The fruit industry is now, therefore, the most important industry in the island, and its expansion is all the more gratifying that it stimulates the cultivation of a number of plants that will be the means of extending large and permanent industries. As a case in point, it may be mentioned that cacao plants can be easily and successfully grown under the shade of bananas, and when the bananas have ceased to bear, the cacao trees will remain in the land and yield regular crops for 40 or 50 years. Before the extension of fruit growing, Jamaica exported little or no cacao. In 1875 the exports were of the value of 873*l.*; in 1883 they had increased to 5,000*l.*; while in 1889 the total value was 11,000*l.* Another large development has taken place in regard to logwood. The value of the logwood exported in recent years has been as low as 106,000*l.* In 1889 this had reached a total of 379,759*l.* This general improvement in the condition of Jamaica has been brought about by the energetic and statesmanlike policy adopted for the last 25 years by Governors like Sir John Peter Grant and Sir Anthony Musgrave. The means of communication by roads and railways have been extended, an efficient telegraph system has been established, and rapid steamship services have been encouraged between the island and the principal ports of the United States and Canada. Perhaps the best proof of the reality of the "New Jamaica" is shown by the energy and success with which the island has lately carried through the arrangements for an

Industrial Exhibition which was opened amidst the greatest enthusiasm and in the presence of a large and brilliant assembly by H.R.H. Prince George of Wales on the 27th January. A few years ago such an exhibition in Jamaica would have been impossible. Its success as an exhibition is felt to be largely due to the personal influence and the capable energy of the present Governor, Sir Henry Blake. He has fully realised the value of fostering every industry calculated to add to the welfare of the people; and, although financially the exhibition will not be so successful as it deserves, it will mark an altogether new epoch in the history of the island.

It is possible here to give only a brief description of the Jamaica Exhibition. The building, about 500 feet long, is designed in a Moorish style of architecture, with a large central court surmounted by a lofty dome and cupola. The large and spacious aisles, fitted with galleries, extend east and west from the dome, and the whole building is very tastefully and effectively decorated. It stands, with dome, transepts, and minarets, in a commanding situation at the head of the racecourse, on a gentle slope overlooking the town and harbour of Kingston. It is surrounded by about 50 acres of ground laid out in ornamental gardens. Both the building and the grounds are lighted throughout with electricity. In addition to the main building there are numerous annexes, including a theatre, a fine-arts gallery, and industrial village, a vivarium, an apiary, a working dairy, and models of various buildings and machinery suggested for use in the prosecution of tropical industries. Every portion of the interior of the Exhibition is attractive and full of interest. The products of Jamaica occupy considerable areas, situated east and west of the dome. They are not so effectively shown as could be wished, but there can be no doubt that an island that can display so varied and so valuable a contribution of the vegetable productions of the tropics must eventually become most prosperous and thriving. Canada has made a great show of her manufactures and agricultural products. Several European countries, such as Austria-Hungary, France, Germany, and Italy, have sent important and valuable contributions. The Mother country is represented in several very striking collections. Her Majesty the Queen has graciously lent portraits of Herself and H.R.H. The Prince Consort, from Windsor Castle. These are placed on each side of the large dome. Nearly one hundred different English firms have exhibits in the main building and in the several annexes. The Exhibition was largely assisted in the United Kingdom by a Committee appointed in London, of which the Right Hon. Lord Knutsford, the Secretary of State for the Colonies, was honorary president, and Mr. Charles Washington Eves, C.M.G., was chairman. Further, the Imperial Parliament made a grant of 1,000*l.* towards the general funds of the Exhibition. The British West Indian Colonies represented at the Exhibition consist of the Bahamas, Barbados, and the Windward Islands, including St. Lucia, St. Vincent, and Grenada. A short account of the exhibits from the Windward Islands is given in Appendix B. Both the Turks Islands and the Cayman Islands, dependencies of Jamaica, have excellent exhibits. The Barbados Court was one of the most attractive of any, and this mother-colony of the West Indies deserves great credit for the enterprising manner in which it has supported the Jamaica Exhibition. The Bahamas Court was also very tastefully arranged, and, as was natural, it contained splendid specimens of the "pita" fibre (Sisal Hemp), which just now is attracting so much attention. The Exhibition will undoubtedly prove of great educational value to the people of Jamaica, and it will so greatly enlarge their views of the value of their resources that whatever money may be required to cover the general expenses of the undertaking, it cannot fail in time to advance the social and material interests of the Colony. In the arrangement of the ornamental grounds surrounding the Exhibition, in decorating the building and in making a complete collection of the plant productions of the island, the Botanical Department has afforded valuable assistance. By means of transplanting machines, supplied through Kew, the grounds have been established within about 12 months with handsome collections of large palms and ornamental trees, clumps of bamboos, tree ferns, and various economic plants, all of which have proved of great interest and beauty.

The Botanical Gardens of Jamaica have a very interesting history. So far back as the end of the last century there were three important gardens in the island containing valuable plants from nearly every part of the world. The old Botanic Garden of the Colony was at Bath, in the eastern part of the island, about 40 miles from Kingston. To this garden Dr. Thomas Clarke was appointed superintendent in 1774. It contained chiefly tropical plants, and here some of the first bread fruit trees and the first mango trees were grown in the island. A private garden of great interest had already been established near Gordon Town, about 9 miles from Kingston, by Mr. Hinton East. A catalogue of the plants was prepared by Dr. Broughton, and published as an appendix to Bryan Edwards' *History of the British West Indies*, vol. 1, p. 475. At the death of the founder this garden was purchased by the Government, and Mr. James Wiles, a gardener who had assisted Captain Bligh in bringing bread fruit, sugar-cane, and other plants from the South Seas, was placed in charge of it. In 1782 there were in Mr. East's garden the mango, akee, cinnamon, camphor, jack-tree, bichy or cola nut, date palm, rose apple, litchi, turmeric, and many valuable tropical and subtropical plants, numbering in all about 600. A third garden had been established some time before 1793, on the slopes of St. Catherine's Peak, at an elevation of 4,300 ft., by Mr. Matthew Wallen, a friend of the great botanist Olavus Swartz. This was for plants of temperate regions. To this garden the Blue Mountain districts of Jamaica are probably indebted for many European plants now found naturalised there. The English oak, common myrtle, white clover, sweet violet, black-berried elder, buttercups, strawberries, wild pansy, groundsel, dandelion, are all no doubt plants that once flourished in Mr. Wallen's garden.

It will be noticed, therefore, that more than 100 years ago Jamaica possessed excellent Botanical Gardens.

Further, in order to utilise those under the control of the Government " separate committees were appointed for each county to receive and " distribute the plants allotted to them . . . . by which " means the public has derived all the advantages to be expected from " these establishments." (*Journals*, House of Assembly, 1791–1807.) The present Botanical Gardens of Jamaica have fully sustained the excellent record of the past. They were reorganised at the instance of Sir Anthony Musgrave as a separate department in 1879, and the present writer was in charge of them until 1886.

They have now as Director, Mr. William Fawcett, B.Sc., F.L.S., assisted by four European superintendents. A sketch of the various establishments is as follows :—

1. *The Botanic Gardens, Castleton.*—Elevation, 580 ft.; mean temp., 76° F.; annual rainfall, 108 inches. Extent about 10 acres. Situated in the parish of St. Mary's, 19 miles from Kingston. The chief features are an excellent palmetum, a collection of economic, spice and fruit trees, a fine collection of orchids, an experimental ground for new industrial plants, and large nurseries containing about 40,000 plants.

2. *The Hill Garden and Cinchona Plantations.*—Elevation, 4,500 ft. to 6,300 ft.; mean temp. at 4,500 ft., 63° F.; average rainfall, 121 inches. On the slopes of the Blue Mountains, 24 miles from Kingston. Plants of sub-tropical and temperate regions are here cultivated. The cinchona plantations cover about 140 acres. The nurseries contain large numbers of plants of timber and shade trees for reforesting purposes, as well as plants suited for cultivation in the higher mountains.

3. *The Hope Garden.* — Elevation, 650 ft.; mean temp., 77° F.; average rainfall, 50 inches. Extent, 220 acres. Situated five miles from Kingston, at the foot of the Liguanea Hills. This garden is destined to become the chief botanical establishment in the island. It is being laid out with great care and judgment. Carriage drives, with ornamental borders, of a total length of more than two miles, have been already made, and a large number of very interesting plants established.

4. *King's House Gardens and Grounds.*—Elevation, 330 ft.; mean temp., 78° F.; average rainfall, 49 inches. Extent, 177 acres. About 20 acres are kept up as an ornamental garden attached to the official residence of the Governor. Many ornamental palms, orchids, ferns, and other plants are cultivated, and very attractive borders have lately been made on each side of the carriage drives.

5. *Kingston Parade Garden.*—Elevation, 50 ft.; mean temp., 80°F.; average rainfall, 35 inches. Extent, 5 acres. This is a public pleasure garden for the town of Kingston, with ornamental trees, flowering plants, tanks for aquatic plants, and fountains. This is also utilised as a depôt for economic plants, and the headquarters of the Department in Kingston.

The old Botanic Garden at Bath has been much reduced in size, and, owing to its remote position, it is of little value or importance. It is, however, maintained as a station, and possibly in the future it may serve as a depôt for plants for distribution in the rich and fertile districts in the eastern portion of the island.

The Palisadoes Cocoa-nut Plantation was established by the Botanical Department on the long strip of sandy land enclosing Kingston Harbour. About 23,000 cocoa-nut trees are now coming into bearing. Having accomplished its special purpose as an experimental plantation, the Palisadoes is now leased by the Government at an annual rental.

The important part taken by the Botanical Gardens, Jamaica, in developing local industries is fully recognised. Their history is almost unique in this respect amongst the botanical institutions of the Colonies. They have contributed largely also to increase botanical knowledge in regard to the flora of the West Indies, and taken a leading part in disseminating sound and practical information respecting the cultivation of all plants suitable for this part of the world. A few years ago, in the whole of the West Indies, there were only two botanical institutions. Now there are eleven. This development is one of the strongest proofs that the islands are recognising the value of systematic organisation of a botanical character for increasing their natural resources, and it affords great encouragement as regards the future.

Before leaving Jamaica I was invited to give the opening lecture in the hall of the Exhibition building on February 9th. The arrangements for the lecture were made by the members of the Horticultural Society, and the President, the Honourable Dr. Phillippo, took the chair. At the request of His Excellency the Governor, who was also present, I treated of subjects of special interest to the island at the present time. These briefly stated referred to the better cultivation of fruits, the larger cultivation of choice early vegetables for northern markets, the systematic cultivation of limes, the most favourable openings for a fibre industry, the improved curing of cacao, and experiments in the cultivation of spices, cola, and gambier.

I left Jamaica for Barbados on board the R.M.S. "Medway" on February 10th.

BARBADOS.

February 10th to February 14th.—The impression carried away from Jamaica was of a thoroughly favourable character. Contrasted with the condition of Jamaica, when I first knew it, in 1879, nothing could have been more changed for the better. If the other British Possessions in the West Indies, such as the Windward and Leeward Islands, could enter upon a similar condition of natural prosperity based on the development of numerous industries suited to the soil and climate, there would be practically an end to the depression which has affected them for so many years. It is to be hoped that what has been done in Jamaica will encourage the smaller islands. They should not, however, merely copy the Jamaica industries, because they happen at the time to be remunerative. This is a weak point in most of our tropical possessions. There are hundreds of small industries suited to the West India Islands where there would be little danger of crowding the markets. Each island possesses its special circumstances, and if these are intelligently and carefully studied there ought to be little difficulty in selecting such industries as shall prove permanently remunerative.

While at Jamaica I received the following letter from Barbados:—

The Colonial Secretary, Barbados, to Mr. Morris.

Colonial Secretary's Office, Barbados,
January 23, 1891.

Dear Sir,

It has been represented to the Governor by the leading members of the Agricultural and Horticultural Societies in this island, that before your departure from the West Indies it might be possible for you to deliver a lecture here on the subject of the cultivation of economic plants suited to West Indian requirements, or on some such similar subject of public interest. I am therefore directed by his Excellency to communicate to you that such a lecture from you would be highly appreciated by the community of Barbados, and that you will confer an obligation on the Colony and on the Government if you can make it convenient to deliver one.

A brief reply by telegram will greatly assist us in making timely arrangements in case such should be necessary.

Yours, &c.
(Signed) C. A. King-Harman.

D. Morris, Esq., M.A., F.L.S.

I consented to give the lecture on the 14th February, the day the "Medway" was expected to touch at Barbados. We duly arrived at 6 a.m. on the morning of the 14th, and I went ashore early, as I was anxious to observe the method adopted for the preparation of Barbados aloes. This old industry still survives in one remote corner of the island, and with the kind assistance of Mr. J. R. Bovell I was able to arrange to drive out to Dodd, and from thence to the College estate, where we were met by Mr. Hollingsed, the manager. After a ride of about three miles past Codrington College we arrived at the College Savannah where the aloe plants (*Aloe vulgaris*, L.) were grown. In the fields were a number of wooden troughs, in which the leaves, after being cut, were placed to drain. The crude juice was carried into a boiling house close by, placed in a large cauldron, and boiled for several hours until it was concentrated into a thick viscid mass. During the boiling process the juice is well stirred by a wooden paddle, and as it thickens it is regularly tested until it has attained the degree of consistency required. It is then placed in gourds, and when hardened sufficiently to bear transport it is ready for market. A more detailed description of the cultivation and manufacture of Barbados aloes will probably be given in a later number of the *Kew Bulletin*.

I returned to Bridgetown about 2 o'clock. I gave my promised lecture in the Council Chamber. The chair was taken by the Governor, his Excellency Sir Walter Sendall, K.C.M.G. The following is an extract from an article in the *Agricultural Gazette*, the official publication of the Barbados Agricultural Society:—

"The community at large is very much indebted to Mr. Morris for the very conclusive and effective lecture which he delivered on the 14th ult., at the Council Chamber, to a large and appreciative audience. We in no wise detract from the merit of Mr. Morris' utterances when we say that he reiterated a thrice told tale. His text has for years supplied the theme on which, in these pages, we have harped both in and out of season; and not harped in vain.

* * * * *

"Mr. Morris' visit was most timely; he came amongst us to tell us of the value of things just at the time when our reason, sharpened by experience, was ripe for receptivity; and so we feel sure his words fell on no barren soil. We have harped for many a year on the 'Minor Industry' string. Mr. Morris has now touched it with a master's hand, and given to it the true pitch and intensity of tone which it lacked, and which will henceforth cause it to give forth no uncertain sound, but a clear, metallic ring, inviting the workers of our busy hive to spend their energy wherever honey may be gathered or stored.

"We have no intention of dealing categorically with Mr. Morris' lecture; its main lesson is too valuable and too obvious, and we would not like to utter a single word that might, perchance, deflect the mind of the producer from the consideration of that lesson: and that lesson is this, 'in these days nothing is too small, nothing too insignificant, 'that it can be despised.' Bananas have made Jamaica prosperous, yielding an export to the value of over half-a-million sterling; and from this at one time small and apparently insignificant industry—but now worth a half-million—as a natural consequence, roads and railways, shipping and telegraphic communication, have sprung into existence as it were by magic, culminating in a noble exhibition."

This lecture at Barbados brought my visit to the West Indies to a close. I embarked on board the "Medway" in the afternoon for England. I arrived at Plymouth on the 25th February, and reached Kew on the following day. My mission had in all occupied 106 days. The distance travelled during this period was a little over 12,000 miles.

SUMMARY.

The chief object of my mission to the West Indies was to give such assistance as might be required by the several Governments in laying out and organising the Botanical Stations established, or about to be established, in the Leeward and Windward Islands. It was a necessary part of my duty in this respect to settle by conference the practical details connected with the working of the Stations from any centre that might be decided upon as most advantageous to them, and to solve the innumerable petty administrative difficulties which had hitherto hindered the effective working of the scheme and given rise to considerable correspondence. While doing this, I had been requested by the Secretary of State to afford as much assistance as possible in regard to the development of local industries and to render generally my visit to the several islands as effective and as useful as the time at my disposal would allow. It will be gathered from my report that I visited first of all the Leeward Islands, and devoted three weeks in carefully planning and organising the Botanical Stations in the islands of Antigua, Dominica, Montserrat, and St. Kitts-Nevis. A detailed report was furnished to the Governor in respect of each Station, and much time was spent with the Curators in discussing and determining the various operations desirable to be undertaken to render the Stations efficient agents in carrying out the special objects for which they were created. In addition the island of Anguilla, in the Presidency of St. Kitts-Nevis, and the island of Tortola in the Virgin Group were visited for the purpose of advising in regard to industries best suited to their requirements. Public addresses were delivered at Antigua, Dominica, Montserrat, and St. Kitts.

I then proceeded to the Windward Islands for three weeks more, and an exactly similar course was pursued in regard to the Botanical Stations at St. Lucia, St. Vincent, and Grenada. Addresses were also delivered in each of these islands, and much time was spent in affording information to the Governments and to those private people who sought it, based on a careful study of their special circumstances. Although Barbados was not included in the scope of my mission as first planned, I was happy to accede to an invitation extended to me while in the West Indies to visit and report upon the Botanical Station at Dodd. I further gave an address in the Council Chamber at Bridgetown on cultural industries. My visit to Jamaica gave me an excellent opportunity of witnessing the great progress made in that island of recent years, and I was able to discuss with the Assistant-Colonial Secretary and with Mr. Fawcett the details of any connexion that might be considered necessary to establish between the Botanical Department of Jamaica and the stations in the Leeward Islands as defined in Sir Henry Norman's letter of the 9th May 1887. At the wish of Sir William F. Haynes Smith I was successful in arranging with private persons in Jamaica to supply from time to time consignments of good seed of Blue Mountain coffee and of other economics procurable in commercial quantities for the Leeward Islands. I was also able to procure for them what they had hitherto failed to receive, viz., a valuable consignment of the suckers of the Jamaica banana required for the American market. I gave the opening lecture in connexion with Jamaica Exhibition on February 9th.

It only remains now for me to refer to the general conclusions arrived at in regard to the supervision of the Botanical Stations.

It has been felt all along that the smaller islands under present circumstances could not support any considerable organisation of their own, but on the other hand if they joined together and affiliated their Stations to one or other of the larger Botanical Institutions at Jamaica or Trinidad, there were good grounds for believing that satisfactory results would be attained. The Stations in the Windward Islands at Grenada and St. Vincent have already been placed under the supervision of Mr. J. H. Hart, F.L.S., the superintendent of the Botanical Gardens at Trinidad, and the arrangement has been in force for a sufficient time to justify its continuance. The Curators, some of them new to tropical conditions, are thus brought into contact from time to time with an experienced and capable head, and they are able to correspond regularly with him in regard to practical details, and to obtain, by exchange, regular supplies of seeds and plants specially required for their gardens. If no other arrangement be eventually practicable, I would suggest that the St. Lucia Station be also placed under Mr. Hart's supervision.

As regards the supervision of the Stations in the Leeward Islands the matter is not so easily of solution. They are to some extent beyond the reach of both the Trinidad and Jamaica Gardens. I am glad, however, to find that the Governments of both these islands are prepared, under certain conditions to lend the services of their officers for the supervision of the Stations in the Leeward Islands. The cost to the islands themselves would be somewhat less than if they had a superintendent of their own, but on the other hand, the rapid development which is taking place in the Leeward Islands and the opportunity which may probably offer itself for combining the office of superintendent with that of Secretary of the newly organised Agricultural Society lead me to the conclusion that if a salary could be provided for the combined offices likely to attract a suitable man, it would be in every way preferable to have the entire services of such a man for agricultural affairs in the islands rather than the occasional visits of an officer from Jamaica or Trinidad. The reasons which appear to justify such a course have already been brought at some length under the notice of the Secretary of State and I need not dwell any further upon them.

The Botanical Station at Barbados has been affiliated to the Jamaica Botanical Department for several years. It pays 20*l.* a year towards the expenses of correspondence and the special privileges it enjoys, and receives in return 100 copies monthly of the *Bulletin* of the Jamaica Department, and regular consignments of seeds and plants at reduced rates. The plants, up to a certain limit, are carried between the two islands by the Royal Mail steamers free of charge. The arrangements, so far, have proved thoroughly satisfactory on both sides, and there is every desire to maintain them.

There are good grounds for believing that the Botanical Station scheme devised for meeting the special requirements of the Leeward and Windward Islands will now be finally set in motion. The Stations are all in a fair way of being established, the Curators are active and intelligent, and the people are most anxious to utilise them as much as possible. It is very clearly understood that the Curators cannot devote much attention to plants of a purely decorative character, and that they are not expected to maintain large areas under cultivation as pleasure grounds. Their special work is to encourage and assist in the development of cultural industries, and the closer they keep to this initial idea the better will they attain the objects set before them.

It has always been considered desirable to associate with the distribution of plants from the Botanical Stations the preparation and distribution of short and practical hints respecting their treatment and cultivation. By means of such hints which might take the form of botanical bulletins on the model of that issued from the Royal Gardens, Kew, the people would be instructed in the conditions and circumstances under which economic plants might be best utilised as objects of remunerative industry. The *Kew Bulletin* was first issued on the 1st January 1887. A *Bulletin* of the Botanical Department, Jamaica, was started in April 1887, and a similar *Bulletin* of the Royal Botanical Gardens, Trinidad, was also started in April 1887. Since that time botanical bulletins have been prepared in connexion with the Botanical Stations at Grenada and St. Vincent, and others are in course of preparation. In many islands the Official Gazette is used for the publication of progress reports and also of extracts from the *Kew Bulletin* bearing on botanical subjects of local interest. This plan is of great utility, especially where no newspapers exist, and it might very well be extended to every island, until it is found practicable to issue a regular bulletin.

As regards correspondence, the Curators of the Botanical Stations should keep in regular touch with the supervising officer, and discuss with him all matters relating to the routine work of the Stations, as well as questions affecting the determination of species, and the supplies of seeds and plants. It is most important that all such matters should be well discussed and elaborated locally before they are officially referred to Kew.

The regulations suitable for the protection and government of Botanical Stations have been fully discussed with the local authorities. Those drawn up for the Botanical Station at St. Lucia (given in Appendix B.) might very well be accepted, with certain obvious modifications for other Stations. At first the Curators will have little time for making botanical collections of dried plants. It would be well, however, for them to study the local flora and make themselves thoroughly acquainted with the indigenous plants possessing interest or of economic value. They should collect and establish such plants in a living state in their gardens and utilise them for the purpose of making exchanges with kindred institutions in the West Indies and elsewhere, and so enlarge their collections without incurring much expense in the purchase of seeds or plants.

The training of young men as gardeners and the dissemination of practical information in regard to the propagation and cultivation of economic plants are most important functions of the Botanical Stations.

I have already dwelt at considerable length on this subject in my public addresses, and I look forward to the Botanical Stations proving most beneficial as schools of practical horticulture in the smaller islands.

In closing my report I desire to express my deep appreciation of the great kindness and courtesy I received everywhere in the West Indies. I was welcomed by all classes of the community from the Governors downwards with such genuine goodwill and such hospitality that my visit, in spite of the necessarily continuous and rapid travelling which it entailed upon me, has left most pleasant recollections upon my mind. To his Excellency Sir William F. Haynes Smith, K.C.M.G., Governor of the Leeward Islands, and to his Excellency the Honourable Sir Walter Hely-Hutchinson, K.C.M.G., Governor-in-Chief of the Windward Islands, with whom I spent several weeks in close relation, to further the objects of my mission, my warmest thanks are especially due.

D. MORRIS.

Kew, April 20, 1891.

APPENDIX A.

The following Rules drawn up for the protection and government of the Botanical Station, St. Lucia, may be usefully placed on record for the guidance of other Stations :—

RULES FOR THE PROTECTION AND GOVERNMENT OF THE ST. LUCIA BOTANICAL STATION.

1. The Governor may from time to time appoint some person who shall have the general supervision and control of the Station.

2.—(1.) The Governor may from time to time appoint any number of persons to be a committee to advise on matters connected with the working of the Station.

(2.) The supervising officer shall be chairman of such committee.

3. The committee shall meet for business at least once a month in the gardens, and at such other times and places as may be appointed by the chairman.

4. The members of the committee shall at all times have free access to the gardens, and may make any inquiries they desire of the Curator touching the working of the Station.

5. The members of the committee shall note in a book to be kept for the purpose, and to be called the Suggestion book, any circumstances connected with the Station which it may be desirable to bring to the notice of the committee.

6. All communications and directions from the committee to the Curator shall be made through the Chairman of the committee.

The Curator.

7.—(1.) The Curator shall, as far as possible, place himself in a position to afford information respecting the cultivation, use, and economic value of plants, and of all other matters which come within the purposes of a Botanical Station.

(2.) If he is unable to afford information in any such matter at the time it is sought, he shall make a note thereof and endeavour to obtain and supply it as soon as possible after.

8. He shall forward to the supervising officer of the Station, within the first week of every month, a memorandum, suitable for publication, giving information as to the work performed in the gardens during the preceding month, as to any new plants or seeds received, as to any matters of interest connected with the station or the agriculture of the colony generally, and drawing attention to any subject of interest in any botanical or other publication.

9. He shall forward to the Governor during the month of January in each year, an Annual Progress Report, extending the information in his monthly memoranda to the whole year. To this report appendices shall be attached, giving—

(1.) A list of books and publications belonging to the Station.
(2.) A list of tools and instruments belonging to the Station.
(3.) A list of plants ready for distribution.

10. He shall be responsible for the up-keep of the Station to the best advantage with the funds placed at his disposal.

11. He shall not incur expenditure without the authority of the Governor.

12. He shall, except when his presence is needed elsewhere in the interest of the Station, be in attendance at the gardens during working hours on every day of the week except Sundays and Public Holidays.

13.—(1.) He shall keep such books as the Governor may from time to time direct.

(2.) A list of such books shall be kept in a conspicuous place in his office.

14. He shall have the control over all labourers and persons employed in the gardens, and shall regulate their work and wages to the best interests of the Station.

15. He shall strictly enforce all rules with regard to visitors.

Visitors.

16. The gardens shall be open for the admission of visitors on every day of the week between 6 a.m. and nightfall.

17. Visitors shall not stand or walk on any garden beds or other parts of the gardens to which free access may not be allowed.

18. Visitors shall not pick or break any plants or flowers in the gardens.

19. No person shall be allowed to carry any load into the gardens.

20. No carriages or vehicles of any description, and no horses or other animals shall be admitted within the gardens.

21. No person shall sell or expose for sale any articles within the gardens.

22. No public meetings, picnics, or gatherings of a similar character shall be allowed within the gardens.

23. No person shall be admitted within the gardens unless decently dressed.

24. Any person who conducts himself in a disorderly manner in the gardens, or contravenes any of the rules for the government of the Station, may be summarily ejected by the Curator, and may also be proceeded against for the contravention of the rules or the disorderly conduct.

Sale and Distribution of Plants.

25.—(1.) Sales of plants, flowers, and fruit shall be according to a scale approved by the Governor.

(2.) Such scale shall be published for general information, and copies shall be placed in conspicuous parts of the gardens.

26. All payments shall be made to the Curator, who shall give a receipt therefor from a counterfoil receipt book.

27. All sums received by the Curator shall be paid into the Treasury weekly, and oftener if at any time the cash in his hands exceeds the sum of five pounds.

28. No plants, flowers, or fruit shall be issued by the Curator, without the authority of the Governor, except on payment of the fees prescribed.

Miscellaneous.

29. A library shall be formed in connection with the gardens, in which the Curator shall place all botanical pamphlets, reports, periodicals, or bulletins, which may be sent him.

Passed the Executive Council, this 12th day of January 1891.

J. B. Cropper,
Clerk of Councils.

APPENDIX B.

The following correspondence relates to the exhibits forwarded from the Windward Islands to the Jamaica Exhibition, 1891.

The GOVERNOR-IN-CHIEF OF THE WINDWARD ISLANDS to Mr. D. MORRIS.

Government House, Grenada,
January 14, 1891.

SIR,

As I am unable to visit the Jamaica Exhibition, I should feel much obliged if you would favour me with a report on the Windward Islands Exhibits. I am anxious to hear, from an independent source, what measure of success has attended the attempts which have been made in the Windward Islands to secure proper representation at the Jamaica Exhibition.

I have, &c.
(Signed) WALTER HELY-HUTCHINSON.

D. Morris, Esq., M.A., F.L.S.

Mr. D. MORRIS to the GOVERNOR-IN-CHIEF OF THE WINDWARD ISLANDS.

SIR, Royal Gardens, Kew, March 2, 1891.

I BEG to acknowledge the receipt of your Excellency's letter of the 14th January, in which you desire to learn "from an independent " source what measure of success has attended the attempts which " have been made in the Windward Islands to secure proper repre-" sentation at the Jamaica Exhibition."

2. I had the pleasure of being present at the opening of the Jamaica Exhibition by H.R.H. Prince George of Wales on the 27th January, and I was able during the following fortnight to spend considerable time at the Exhibition, and carefully examine the various articles on view there.

3. In the first place I would mention that the Exhibition building is one of the most attractive ever built for an International Exhibition. It is strikingly situated at the head of the Racecourse facing Kingston and the sea; and it has a magnificent panorama of hills at its back culminating in the Blue Mountains rising to elevations of 6,000 to 7,500 feet. The grounds adjoining the Exhibition are tastefully laid out. Numerous palms, bamboos, and tropical trees and shrubs have been successfully transplanted and established there by the Botanical Department of the Colony; while dotted about are industrial villages and models of sugar, coffee, cacao, and other "works" and appliances illustrating the methods adopted for curing and preparing tropical products.

4. The arrangements in the interior of the main building have been carefully planned and intelligently and tastefully carried out. The West Indian Colonies represented (consisting of Barbados, the Windward Islands, and the Bahamas) occupy prominent positions in the building and are grouped as nearly as possible around the central dome. All the

Colonies mentioned have been successful in adding greatly to the interest of the Exhibition; and they deserve to be highly commended for the enterprise shown by them in supporting what is undoubtedly the most successful Exhibition, so far, held in any portion of the West Indies.

5. The exhibits of the Windward Islands occupy positions on the northern side of the central dome. The St. Vincent court is to the right, and the St. Lucia and Grenada courts are to the left of the main aisle leading from the dome to the north door. These courts have been planned and arranged by Mr. P. C. Cork, the Honorary Commissioner, and Mr. T. B. C. Musgrave, Superintendent for St. Vincent. The results of the labours of these gentlemen are apparent in the very tasteful and successful way in which the various articles are displayed, and the facility with which they can be examined by those specially interested in them.

6. I may say at once that both in the number of articles displayed and in the manner in which they have been prepared the exhibits in the St. Vincent Court are of exceptional merit. A simple enumeration of them covers seven pages in the official catalogue. This last statement, however, gives but a very poor idea of the real nature and character of the exhibits. They consist of nearly everything relating to the mineral and vegetable productions of St. Vincent, and suggest in a striking manner the numberless resources of the island capable of being developed under suitable circumstances.

7. The principal articles consist of sugar, rum, arrowroot, starches, tapioca, cacao, coffee, numerous fibres, tanning materials, ginger, nutmegs, cinnamon, mace, black pepper, turmeric, tobacco, cigars, carib baskets and wicker work, medicinal plants, honey and bees' wax, fruits in syrup and crystallised, jams, jellies, walking sticks, native timbers, native cordage, fishing lines, carib stone hatchets, vegetable oils, building stone and lime, antimony, native hats, native made leather, spa mineral waters, and an inlaid table (containing over 5,000 pieces of 30 native woods.) Of purely botanical collections Mr. George W. Smith has contributed a named set, numbering about 200 species, of St. Vincent ferns; Mr. D. A. MacDonald a set of St. Vincent mosses and ferns; and Miss Maling a set of St. Vincent grasses. The Government of St. Vincent exhibits a collection of native plants, prepared by Mr. Geo. Smith, possessing medicinal and commercial value. To each plant a few notes are added explanatory of the use for which it is adapted.

8. Possibly the most striking and suggestive of the raw products of St. Vincent are its excellent fibres and fibrous materials. There are several very complete sets of these. One set, prepared by Mr. Powell, Curator of the Botanical Station, exhibits the fibres in a remarkably fine condition. Such fibres as "lapite" prepared from a wild variety of the common pine-apple; "gri-gri" skilfully prepared from the young leaves of a palm; and "china" prepared from the petiole of a species of *Anthurium*, are good examples of what St. Vincent is capable of producing, while the fibre of a form of *Agave rigida* to which attention has lately been directed at St. Vincent is excellent in quality, but apparently too short to compete successfully with the best sorts of Sisal hemp, as produced in the Bahamas and elsewhere. The woods of St. Vincent are well shown by Mr. E. M. Beach (53 samples), Mr. J. G. Nanton (6 samples), and Mr. H. Powell (52 samples). There are several exhibits of turnery work, illustrating the character of the St. Vincent woods. Few West Indian Colonies can produce better woods.

9. The articles of Carib manufacture are a special production of St. Vincent. It is one of the few places, if not indeed the only place, in the

Lesser Antilles, with the exception of Dominica, where there are still to be found some of the aboriginal inhabitants. The Carib baskets, fibres, cordage, fishing lines, and other articles exhibited in the St. Vincent court possess great interest. This interest is increased by the fact that the Government of St. Vincent has despatched six Caribs to the Jamaica Exhibition to carry on the work of basket-making in one of the industrial villages. Altogether I regard the efforts made by the St. Vincent Government to secure a proper representation at the Jamaica Exhibition as exceptionally successful.

10. I come now to the Grenada and St. Lucia courts. In point of size and the number of exhibits neither of these attain to the standard of the St. Vincent court. The islands themselves are quite as fertile and their productions are probably equally interesting, but as regards their representation at the Jamaica Exhibition they have not been equally successful. The Grenada exhibits consist of a fine series of cured cocoa, the staple industry of the island. There are several fine samples of sugars and rums ; of spices such as nutmegs, mace, ginger, cardamoms, cloves, and cinnamon ; of Arabian and Liberian coffee ; of native woods, fibres, starches, preserves, jellies and sauces, tobacco, native grown rice, of cotton from Carriacou and Cannouan, some of the few places where cotton is still cultivated in the West Indies. In the industrial village was shown a model of Mr. Messervy's hot water apparatus for curing cacao. This apparatus is capable of being adapted at a small cost to the ordinary "boucan" found on Grenada estates. The heat is applied by a simple low-pressure boiler.

11. The St. Lucia exhibits consist of vacuum-pan crystallized and muscovado sugars, rum, cotton, fibres, syrups, tobacco, limejuice, pickles, starches, native woods, grain d'ambrette (*Hibiscus Abelmoschus*) or vegetable musk, and plants said to possess medicinal properties. Amongst these latter are some leaves of a species of *Clusia* said to be useful in cases of enlarged spleen. Mr. Garraway furnishes the following particulars :—" The Aralie leaves (*Clusia rosea*) are used by Creoles " as a remedy for enlarged spleen. In the green state, the full grown " leaves are thick and leathery. Before applying them, they are " softened over a lamp, and smeared with candle grease. They are " then laid on the swollen side, four or five in ordinary cases, so as to " overlap one another. Fresh leaves are applied night and morning, " and this is continued for eight or ten days. The remedy is worth " trying where coolies, so subject to enlarged spleen, are employed. " The leaves being fixed in place by a broad belt round the waist, the " patient can go about his ordinary duties, take no medicines, and eat " and drink as usual."

12. The clay pipes and flower pots from St. Lucia show that excellent pottery material is found in the island. In fact, it is evident from all the articles sent from St. Lucia, although in this instance very few, and not specially worked up, that the island is practically undeveloped as regards its natural wealth, both vegetable and mineral.

13. Before closing this brief, and necessarily very incomplete account of the exhibits from the Windward Islands at the Jamaica Exhibition, I would desire to express the pleasure I felt in seeing these islands so fully in sympathy with the present development in West Indian industries. Jamaica has taken wonderful strides during the last few years in such industries, and the prosperity which has resulted to Jamaica on this account will, I hope, before long, extend also to the other islands in the West Indies. As Governor-in-Chief of the Windward Islands it must afford your Excellency great pleasure to see that

the people in these islands are awaking to the possibilities within their reach, and making such energetic and most successful efforts to develop their resources.

I have, &c.
(Signed) D. MORRIS.

His Excellency
The Hon. Sir Walter Hely-Hutchinson, K.C.M.G.

The GOVERNOR-IN-CHIEF OF THE WINDWARD ISLANDS to Mr. D. MORRIS.

SIR,
Grenada, March 19, 1891.

I HAVE the honour to acknowledge, with thanks, the receipt of your interesting and valuable report on the exhibits of the Windward Islands at the Jamaica Exhibition.

I am forwarding a copy to the Secretary of State for the Colonies, and copies to the Administrators of St. Vincent and St. Lucia, and to the Governor of Jamaica.

I have, &c.
(Signed) WALTER HELY-HUTCHINSON.

D. Morris, Esq., M.A., F.L.S.

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 55.] JULY. [1891.

CC.—GOLD COAST BOTANICAL STATION.

The success which has attended the efforts made by Sir Alfred Moloney to establish a Botanical Station at Lagos [noted in the *Kew Bulletin*, 1888, p. 149; 1889, p. 69; 1890, p. 162; and 1891, p. 46] has led to efforts being made to establish stations at others of our West African Settlements. The most successful, so far, of these latter is undoubtedly the Botanical Station in course of being established at Aburi, a hill village in the Colony of the Gold Coast.

The history of the establishment of this station is given in the following correspondence. The station is in charge of Mr. William Crowther, a gardener trained at Kew, who was appointed in January 1890. His Excellency Sir W. Brandford Griffith, K.C.M.G., the Governor, takes a deep personal interest in the work of the station, and the results so far attained are very promising.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
88 and 90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.
Price Twopence.

GOVERNOR OF GOLD COAST to COLONIAL OFFICE.

MY LORD, Accra, 28th August 1888.

IN my Despatch No. 53, of the 2nd of March last, in section 11, it was stated: "At Aburi, which has mountain slopes of southern "aspect and a fertile soil admirably suited for coffee and cocoa, the "former of which is already cultivated to some extent, owing to the "example of the members of the Basel Mission stationed there, I also "emphasised the advantages of agriculture to the Africans of the place, "and endeavoured specially to stimulate the local native sluggishness "in which some leaven of industry has begun to show itself. I had "already ordered a space of about three acres to be cleared of bush, "with a view to the commencement of and concentration of the expen"diture upon gardens at out-stations on the cultivation of a model "farm, as well as with a view of improving the sanitary surroundings "of this house; and I am hopeful that I may see my way at no distant "date to place before you a definite scheme on the subject." In my Despatch No. 232, of the 30th of June, I referred to the subject in paragraph 19, and stated that I should presently do myself the honour of submitting to your Lordship a scheme for the formation of an agricultural farm at Aburi under the charge of a fit and competent man from Jamaica or Trinidad.

I have now the honour of bringing the proposed scheme more particularly under your Lordship's notice. The "Bulletin of Miscellaneous Information" for June, issued by the Director of the Royal Gardens at Kew, refers to this Colony in the following extract from page 150:— "The principal West African Colonies are the Gambia, Sierra Leone, "Gold Coast, and Lagos. The extent of these Colonies may be estimated "from the fact that the coast line of the Gold Coast Colony alone is "350 miles, and that the total area of the British Protectorate is from "24,000 to 30,000 square miles. The staple products of this Colony "are palm oil and palm kernels, but among other exports are copra "(from the cocoa-nut palm), guinea grains, gum copal, camwood, and "beniseed. If once the Natives inhabiting magnificent lands in this "Colony were taught to cultivate economic plants in a systematic "manner for purposes of export, the material wealth of the Gold Coast "might be enormously increased."

It was mainly with the view of teaching the Natives to cultivate economic plants in a systematic manner for purposes of export that I have contemplated for some time the establishment of an agricultural and botanical farm and garden, where valuable plants could be raised and distributed in large numbers to the people in the neighbourhood in the first instance, and afterwards sent further into the country by pupils whom I contemplate taking from the schools when willing to give their attention to industrial pursuits. By their labour and agency, when sufficiently educated for the purpose, additional farms or gardens could be started, and by these means the people generally would become acquainted with the fact that other products than those indigenous to the country had been introduced into it, were thriving and would be remunerative, and thus observing the advantage to be gained by their propagation, would be disposed to cultivate them. By this mode of procedure I trust that in time it will be possible to raise sufficient quantities of new productions which may, in the not too distant future, add considerably to the value of the exports from the Colony.

With these objects in view, when passing through Aburi in March last, I instructed the Surveyor-General that he was to have surveyed and marked out a large additional tract of land adjoining that around the house at Aburi, which is already the property of the Government, for acquisition under the Public Lands Ordinance, No. 8, of 1876. The hill slopes and soil of Aburi are admirably suited for the cultivation of cocoa, coffee, cloves, cinnamon, nutmegs, vanilla, and other useful products. Cocoa and coffee, as previously stated, are already grown to some little extent by a few of the Natives, who have followed the practical example set to them by the Basel Missionaries at Aburi and Akropong.

A sum of 300*l.* has been inserted in the estimates for 1889 for an agricultural and botanical garden at Aburi.

* * * * * *

I have purposely put the initial expenditure of the scheme at a low figure as it must be somewhat in the nature of an experimental measure, the success of which will largely depend upon the energies of the officer selected as superintendent, but I have every confidence that those who direct the Botanical Gardens at Kew, Mr. Morris especially, who has been out in Jamaica, would be willing to afford this Colony the necessary assistance to ensure the choice of a man who would not fail to bring about that success. Furthermore the climate of Aburi is comparatively healthy.

* * * * * *

I have, &c.
(Signed) W. BRANDFORD GRIFFITH,
Governor.

The Right Hon. Lord Kutsford, G.C.M.G.,
&c. &c. &c.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, October 12, 1888.

I AM desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 27th September on the subject of a proposal to establish a Botanical Garden at Aburi, on the Gold Coast.

The details of the scheme set forth in the Despatch of Sir Brandford Griffith of the 28th August appear to have been carefully and judiciously planned; and it is evident that the proposed Botanical Garden, if successfully worked, would prove of considerable value in stimulating the attention of Natives to the cultivation of economic plants, and in disseminating useful information respecting them.

The future prosperity of the West African Settlements would appear to depend very much on how far the natives inhabiting rich and fertile lands not far from the Coast can be led to cultivate certain plants, and prepare the produce so as to give rise to commercial intercourse with other countries. The gathering and shipping of mere forest products have already shown signs either of becoming exhausted or of becoming depreciated in the world's markets.

Sir Brandford Griffith has fully grasped the practical aspect sought to be given to the proposed experimental garden and nursery at Aburi. It is to be established, he says, " mainly with the view of teaching the " Natives to cultivate economic plants in a systematic manner for " purposes of export." Steps are also to be taken to train pupils in planting pursuits, and generally diffuse a knowledge of practical horticulture amongst the people.

As regards the site of the proposed garden, it is always desirable to place such an institution as near as possible to the seat of the Government, and easily accessible to a large section of the population. Doubtless these points have been duly considered in the selection of Aburi. The soil is stated to be good and the locality fairly healthy.

* * * * * *

I have, &c.
The Hon. R. H. Meade, C.B. (Signed) D. Morris.

Sir W. Brandford Griffith to Royal Gardens, Kew.

My dear Sir, Aburi House, April 5, 1890.

I beg to acknowledge the receipt of, and to thank you for, your kind letter of the 25th February, in which you are good enough to inform me of the receipt of the telegram I sent from Bathurst on my way to Accra, and the steps which Mr. Thiselton Dyer and yourself have so kindly taken to meet my request.

Mr. Crowther arrived here on the 16th ultimo, and I have much pleasure in stating that I owe you many thanks for having selected for me an officer who appears, from the short acquaintance I have had with him, to be possessed of all the good qualities I could wish for in a man selected to fill the appointment he now holds.

You will be interested to learn that I left Accra on the 1st March, for this place, having come up for the purpose of pushing on the work of clearing the forest and bush on the farm preparatory to Mr. Crowther's arrival. We have now nearly 8 acres ready for sowing and planting, seven of which have been recovered from the forest and bush and put in capital order, and the Curator has already sown several thousand coffee and cocoa seeds as well as those of other kinds in smaller quantities. I have also written to the Governors of Trinidad, British Guiana, and Jamaica, requesting their kind offices in aiding my work by sending to me plants and seedlings in accordance with a long list transmitted to them. I should mention here that some years ago a Wardian case, containing plants, was sent to me at Lagos from Trinidad through Messrs. Elder, Dempster, & Co., Liverpool, and the plants did not suffer at all from the long voyage.

I note what you state with regard to the Egyptian cotton, and I have given Mr. Crowther minute and special instructions that it should be placed on record that when any is harvested specimens are to be sent to me for the purpose of being forwarded to Kew for your information, and for examination by an expert as you so kindly offer shall be done.

The Natives for many miles round are already evincing much interest in this experiment on the part of my Government, and I feel confident that the good beginning which has been made will be carried on until the useful and beneficial aim for which this centre has been established, is accomplished.

With kind regards to you, and to Mr. Thiselton Dyer,

Believe me, &c.
D. Morris, Esq., (Signed) W. Brandford Griffith,
Royal Gardens, Kew. Governor.

CURATOR, BOTANICAL STATION, ABURI, to ROYAL GARDENS, KEW.

SIR, Botanical Station, Aburi, July 1890.

I HAVE the honour to acknowledge the receipt of a packet of seeds, including three species of Eucalyptus, together with notes upon them. I also beg to acknowledge receipt of a box of Palm seeds (*Bactris sp.* and *Livistona sp.*) and a box of Mahogany seeds, all of which were received in good condition.

In regard to my work at Aburi, I would beg to inform you that most of the seeds received from the Royal Gardens, Kew, have been sown. Many of them have germinated and are growing well, notably the two varieties of Egyptian cotton, which are just now coming into flower. They were sown at the commencement of the rainy season, and have grown most luxuriantly. [A report upon this will be found in the *Kew Bulletin* for March, 1891.]

The plants received from Kew are all growing satisfactorily, and seem to be adapting themselves to the climate.

The Governor, Sir W. Brandford Griffith, who takes a great interest in the working of the garden, has supplied many valuable seeds, including Cinchona, Casuarina, Tobacco, Indigo, Jute, Cotton, Liberian Coffee, Theobroma Cacao, 400 Cocoanuts, &c. His Excellency also expects a lot of seeds and plants from the West Indies shortly.

I think Aburi is a very proper place for a Botanical Station. It is at an elevation of 1,400 feet, and the vegetation around is very luxuriant. Most years there is a copious rainfall, extending, more or less, from March to November, and the temperature seldom exceeds 87° or 88° in the shade. The soil also is very good, consisting chiefly of vegetable matter, and there is a spring of fresh water within about a quarter of a mile of the garden.

I have, &c.
(Signed) W. CROWTHER.

D. Morris, Esq.,
Royal Gardens, Kew.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 12th June 1891.

I AM directed by the Secretary of State for the Colonies to transmit to you, for your information, a copy of a Despatch from the Governor of the Gold Coast relative to the Botanical Station at Aburi.

I am, &c.
(Signed) ROBERT G. W. HERBERT.

The Director of the
Royal Gardens, Kew.

GOVERNOR OF THE GOLD COAST to COLONIAL OFFICE.

Government House, Christiansborg Castle,
Accra, 6th May 1891.

MY LORD,

I HAVE the honour to report that I left Christiansborg at 8.25 p.m. on the 2nd instant, and arrived at Aburi House, for the purpose of inspecting the Botanical Station, at 11.25 p.m. the same evening. I halted at Timan for an hour and proceeded for about 10 miles of the way in a hand-cart. The road was good, and I might have been drawn the whole way in the cart had I been so minded. Returning yesterday, I left Aburi at 12.35 p.m., and reached Christiansborg at 6.35, thus taking only six hours *en route* and travelling 16 miles in a hand-cart.

2. I found the station in excellent order, which left nothing to be desired on the part of the Curator, Mr. Crowther, so far as I can see. When I arrived at Aburi in March 1890, I found one acre of land clear of bush and forest trees. I cleared seven acres myself before, and shortly after, the arrival of Mr. Crowther in the same month; since then Mr. Crowther has cleared 15 acres, two acres of which consist of garden beds for seedlings. He has constructed five workmanlike potting-sheds in good positions, and the 13 labourers whom I brought down from Monrovia as a permanent labour gang have for the most part turned out well and built themselves neat and comfortable huts, to which are attached patches of garden land which they work for themselves. The rainfall for the year Mr. Crowther has been at Aburi was 60 inches, but heavy mists prevail in the early morning throughout the year, which are most helpful to plants. He has enjoyed excellent health the whole time. He has hardly lost any of all the different kinds of valuable economic plants which have been received from various quarters. Liberian coffee has grown very well; there are some 7½ acres of it planted out, 3½ permanently and the rest for transplanting purposes. The annatto dye plants, some six feet high, are flourishing. The different fruit plants are very promising. The Egyptian cotton grew well. Since the local publication of the correspondence with regard to this article, applications have been received for supplies of seed from Messrs. Bannerman and Fearon, two influential native proprietors, which I regard as a hopeful sign. The beefwood (*Casuarina equisetifolia*) trees which have been planted are growing well. The cinchona seed received from Paris has failed. The leaf of the tobacco grown is splendid, but it is a question whether the climate will admit of its curing by other than artificial means. There is no native demand as yet for it, but Mr Leach, the agent of Messrs. Swanzy at Akuse, has bought seeds both of tobacco and cotton. The cultivation of European vegetables has met with the greatest success. The lettuce I tasted there was as good as that of the best European gardens. I propose to make permanent arrangements for the transport to Accra of green food and vegetables free of cost to the officers, looking to their importance as a means of the promotion of health. The different varieties of ornamental plants have grown well, as have also kola nuts and shea butter trees, indigenous to the country. The soil has proved to be of the richest, and on the sides of the hills is of good depth. I was glad to observe patches of clearing on the mountain slopes facing the Basel Mission Station of Abokobi, at the foot of the range. Along the road to Accra also I saw much more evidence of country gardening than has ever been attempted before. I am told that the natives come and look on at the operations at Aburi with interest, and when the results of the agriculture and arboriculture which are being pursued become more patent than they even now are, the model which is thus put before them cannot, I should think, fail to impart to them the desired industrial stimulus; this may take time to effect, but I doubt not as to its ultimate success, if the management of the station should proceed as well as it has commenced. A native has recently purchased 500 Liberian coffee plants at 1½*d.* each; Chief Atta Fuah of Western Akim has applied for cocoa plants, and other small sales have also been made. During my visit to the place, of

two days and a half, I inspected the village of Aburi, which I found clean and in good order, and I also went over a patch of land of some 14 acres belonging to the Rev. Mr. Clarke, a native minister, which I think should be acquired by the Government and added to the Government property. I will submit the question to the Legislative Council at its next sitting. The cost will be very trifling. Lieutenant-Colonel Cash and Assistant-Inspector O'Donnell, of the constabulary, with Dr. Gunn in attendance upon them, were at Aburi during my visit, convalescing from illness and, I am glad to state, recovering rapidly.

3. The term of service of Mr. Crowther, the Curator, expired on the 14th ultimo, and I had brought Mr. Eyre with me to Aburi to relieve him, but when I found on arrival that Mr. Crowther was in such good health, and as he cheerfully expressed his willingness to comply with a suggestion which I made for his consideration that, looking to the large amount of valuable Government property which he had so far successfully brought to a critical stage, he should remain in the Colony a little longer, before going on leave, to superintend the transplanting from the seedling beds of the different young plants with the advent of the rainy season and initiate Mr. Eyre into his duties, I was glad to avail myself of his offer. Mr. Eyre's term of residential service also expired on the 5th instant, but he does not desire to return to England, and is only too glad to have the opportunity of continuing his service in the healthy climate of Aburi, whilst engaged upon work which is congenial to him, and of which he has had previous experience when employed upon plantations in Fiji. I am of opinion, moreover, that it will be of advantage to the public service that he should be allowed to do so, as there is no other officer who is available for the service. I apprehend that, in the circumstances, his offer will entitle him to the usual extra leave under paragraph 424 of the Colonial Regulations.

I have, &c.
(Signed) W. BRANDFORD GRIFFITH,
Governor.

The Right Hon.
Lord Knutsford, G.C.M.G.,
&c. &c. &c.

CCI.—BAHAMAS INDUSTRIES.

One of the most interesting circumstances connected with the economic development of the Bahamas Islands is the great attention devoted within the last few years to the planting of Sisal hemp (*Agave rigida* var. *sisalana*). This subject has already been discussed in the *Kew Bulletin*, 1889, p. 57; 1889, p. 254; and 1890, p. 158. In a recent report in the Blue Book for the year 1890, Sir Ambrose Shea, K.C.M.G., the Governor of the Bahamas, supplies the following particulars respecting this and other agricultural industries connected with the colony:—

Agriculture.

Apart from the fibre cultivation agriculture is confined chiefly to pine-apples. The people raise maize and sweet potatoes for their own use, and their maintenance is much assisted by these crops. Cotton shows an increase, being 1,593*l.* in value compared with 1,074*l.* in 1889.

There is no reason why this business should not be extensively prosecuted, as most of the islands are well adapted for its cultivation. It is hoped that the presence of strangers now coming in to pursue the fibre industry will act on cotton productions, to the advantages of which their attention cannot fail to be directed. It is quite possible that, in time, cotton may be found only second to the fibre in the category of exports from the colony. The pine-apple crop realised 49,795*l.*, as compared with 25,558*l.* in 1889. Of canned pine-apples there were exported 26,789 cases, valued at 6,126*l.*, and in 1889 the export was 21,683 cases, with a value of 4,500*l.* In oranges there was an export of 3,961*l.*, the output of 1889 having been 3,040*l.* Careless culture and a reckless mode of shipping, very often in bulk in vessels' holds, must militate against the success of the orange growers. There are advantages for the cultivation of oranges in these islands not known in Florida, as we are proof against frost, which often visits that country. This branch of employment may also be favourably affected when men of enterprise from outside, appreciating the opportunity, use it with energy and the application of well-ordered methods of packing and shipping.

Fibre Cultivation.

Steady progress continues to be made in this industry, with increasing faith in its value and permanence. A report of the cultivation to the present time has been prepared by order of the Government, which, though strictly accurate, would not convey true impressions to those at a distance.

The report speaks of 4,100 acres being already planted with 2,500,000 of plants, but it states that there are also 1,300,000 plants in nurseries, which, being in course of growth, adds 50 per cent. to the active cultivation, making an aggregate of over 6,000 acres. Plants are now kept much longer in nurseries to lessen the cost of weeding, which is an expensive operation, and annually attended to after the plants are set out in the fields.

There has been some question as to the time to bring the plantings to maturity, but four years is now the accepted period, while plants retained in the nurseries, as above stated, will mature in three years. There is but little to add to former reports on this enterprise, which has passed out of the experimental stage and will not probably present any new features of interest until exports of fibre begin, which will be, on a moderate scale, in 1892, then developing annually into proportions of increasing importance.

The value of the fibre, like that of other products, will, of course, be subject to market conditions from time to time, but, in the natural order of things, it will ever be the main export and, regarding all the surrounding circumstances, it is difficult to see how it can fail to pay present investors handsomely and to be, to them, a source of income less liable to fluctuations than is the case with most commercial adventures. The time is now approaching when the machines for separating the fibre from the leaf will acquire practical importance ; of those now in use none seem to meet all the requirements. Some of them clean the fibre well ; but the process is wasteful, and the correction of this defect is the object to be accomplished. With so great an interest at stake we must suppose inventive genius will be found equal to the occasion. Professor Edison has directed his attention to the matter of decortication and he hopes he has found an effective method which avoids waste. The treatment is by a solution of crude petroleum, and this Government are now in communication with the Professor. If the results meet our requirements, a most important end will be attained, which will have the further advantage of enabling small cultivators to dress their own leaves instead of being compelled to sell them at a loss to a large neighbouring planter, who is able to procure a machine.

The process being enterprised by Professor Edison embraces other and most valuable interests in this colony. Many thousands of tons of pine-apple leaves are now annually left to waste. The fibre commands a high price, from 60*l.* to 80*l.* a ton, for use in fine textiles. The small quantity now produced comes from China, where it is roughly and expensively prepared for want of a machine sufficiently delicate to extract the tender fibre without injury. The proposed mode would seem to meet this difficulty, as all strain or friction is avoided, and the result of pending inquiries is looked for with great interest. The immediate effect of successful experiment would be to turn a wasted product into an article of much value, adding substantially to the returns of pine-apple cultivation and this process may be applied to the growing crop. It is understood that the same solution may be used many times, and, if present hopes are realised, the petroleum will be admitted free of the duty now imposed.

CCII.—ARGEL LEAVES.

(*Solenostemma Argel*, Hayne.)

Alexandrian Senna of commerce has commonly been adulterated with Argel leaves yielded by *Solenostemma Argel*, Hayne, a native of Upper Egypt, Nubia, and the northern parts of Arabia. It is figured in Bentley and Trimen's Medicinal Plants (tab. 175). It appears to have formerly been the custom "to mix two parts of Argel leaves with eight " of senna leaflets, and the mixture thus formed constituted commercial " Alexandrian Senna."

Argel leaves may be known from senna leaflets by their paler colour, more leathery texture, less conspicuous veins, and by being equal-sided at their base. It appears from the experiments of Christison "that " they possess little or no purgative effect, but cause sickness, griping, " and other unpleasant symptoms." They were principally collected by the Arabs in the valleys of the desert to the east and south of Assouan. They were thence sent to Cairo to be mixed with true senna leaflets.

No authentic specimen of Argel leaves existing in the Kew Museum, an application was made to the Foreign Office to procure a sample. In the correspondence given below it will be noticed that during the last few years, since the trade with the Soudan has been closed, Argel leaves have not been brought into Egypt.

Royal Gardens, Kew, to Foreign Office.

Sir, Royal Gardens, Kew, 31st October 1890.

I am desired by Mr. Thiselton Dyer to inform you that the leaves of a plant, native of Upper Egypt and Nubia, known as *Solenostemma Argel*, are said to be used for adulterating commercial senna leaves at Alexandria.

In the Museums of Economic Botany at Kew an attempt is made to furnish as complete a series as possible of every economic substance derived from the vegetable kingdom. In certain cases it is sought also to supplement these by exhibiting substances used for purposes of adulteration. In this way such substances may be the more readily detected.

In this particular instance the use of the leaves of *Solenostemma* as an adulterant of commercial senna may be decidedly injurious, as the plant belongs to the Asclepiadacæ, a natural order containing plants which, as a rule, are of a poisonous character. In nearly all there is an acrid juice of a drastic character.

As no other means are available to this establishment, Mr. Thiselton Dyer would esteem it a favour if the Secretary of State would invite the assistance of Her Majesty's Agent and Consul-General at Cairo to procure a small quantity, about a pound in weight, of the dried leaves of *Solenostemma* for the use of the Royal Gardens.

I am, &c.

Sir Villiers Lister, K.C.M.G. (Signed) D. MORRIS.

Sir E. BARING to FOREIGN OFFICE.

MY LORD, Cairo, January 22nd, 1891.

ON receipt of your Lordship's Despatch, No. 43, Commercial, of the 4th November last, I asked Mr. Wallace, the Director of the Agricultural College in Egypt, to endeavour to procure for me some of the dried leaves of the *Solenostemma Argel*, in compliance with the desire expressed by the Director of Kew Gardens.

I have now been informed by Mr. Wallace that he has ascertained that the leaves of this plant are not now to be found in Egypt.

They were, he says, formerly brought in from Nubia, before the events of the last few years closed the trade with the Soudan, but they are not brought in now. Mr. Wallace has promised to do his best to get some of the leaves from Nubia, but before he can do so there may be some difficulty and delay.

I have, &c.

The Marquis of Salisbury, K.G., (Signed) E. BARING.
&c. &c. &c.

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, 16th June 1891.

WITH reference to your letter of the 31st October last, I am directed by the Secretary of State for Foreign Affairs to transmit to you, to be laid before the Director of the Royal Gardens, Kew, the accompanying specimens of *Solenostemma* leaves which Sir E. Baring has, at last, succeeded in obtaining from Nubia.

I am, &c.

The Assistant Director, (Signed) JAS. FERGUSON.
Kew Gardens.

CCIII.—PARAGUAY JABORANDI.

(*Pilocarpus pennatifolius*, Lem.)

In 1881 there was received through the Foreign Office from Mr. E. H. Egerton, C.B., then Her Majesty's Chargé d'Affaires at Buenos Ayres, a supply of leaves of "Jaborandi," an alkaloid-producing plant found in Paraguay. The Jaborandi usually met with in commerce comes from Brazil. It is especially found in the neighbourhood of Pernambuco, growing in forest clearings, on the slopes of the hills. The leaves and young shoots are used for their sialagogue and diaphoretic properties. The active principal of Jaborandi is an alkaloid to which the name of Pilocarpine has been given.

Professor Oliver, F.R.S., the late keeper of the Herbarium and Library of the Royal Gardens examined the Jaborandi received from Mr. Egerton, and made the following report upon its botanical identity :—

"The Jaborandi received from Mr. Egerton seems identical with specimens in the Kew Herbarium from Paraguay, collected by Gilbert and Balansa, referred to *Pilocarpus pennatifolius*, Lemaire.

"The Herbarium also contains leafy specimens (without inflorescence) of the Pernambuco Jaborandi, which probably belong to an allied but different species, judging from the indentation and the form of the base of the leaflets.

"*P. pennatifolius* appears to have been introduced from St. Paulo, but Baillon has identified with the species fragments gathered in Corrientes by Bonpland.

"I doubt if *P. selloanus*, Engl. be distinct."

The Paraguay Jaborandi appears to be less effective than the Brazilian. The particular characteristics of the former are carefully worked out in the following correspondence. It has not been found possible to carry the matter further, and the information acquired is placed on record for the use of those interested in the subject.

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, 1 September 1881.

I AM directed by Earl Granville to transmit to you herewith, for your information, an extract from a despatch from Her Majesty's Chargé d'Affaires at Buenos Ayres respecting certain vegetable products of Paraguay.

I am, &c.
(Signed) T. V. LISTER.

Sir J. Hooker, K.C.S.I.,
&c. &c. &c.

EXTRACT from Mr. EGERTON'S No. 5 COMMERCIAL of July 31, 1881.

IN answer to my numerous inquiries respecting medicinal dye and fibrous plants, I learnt that one of the most remarkable of the former is a plant which grows in great quantities in Paraguay, the virtues of which first became known in Europe about six or seven years ago, called Jaborandi, from which a product called Pilocarpine is made, which is unequalled for its effect as a sudorific. There are said to be two kinds of this plant in Paraguay, one of which only is efficient.

There is a plant, which is extremely common, called the yambayu, which the Indians consider—and is used at Buenos Ayres—as a cure for asthma; but, from what I learn, its virtues in this respect have been exaggerated, and it is not likely to become, like Jaborandi, an article of commerce.

Mr. Villiers Lister presents his compliments to Sir Joseph Hooker and begs to state that he is directed by Earl Granville to forward the accompanying extract from a letter from Her Majesty's Chargé d'Affaires at Buenos Ayres respecting the "Jaborandi," an alkaloid producing plant found in Paraguay. The leaves of the plant mentioned by Mr. Egerton are sent in a separate packet, and Mr. Lister is to request that Sir Joseph Hooker will distribute samples thereof to the College of Physicians or to any other institution to whom the plant might be of use or interest.

Foreign Office,
September 5, 1881.

EXTRACT from a Letter from Mr. EGERTON.

Buenos Ayres, July 30, 1881.

FROM Pernambuco I understand that the leaves of a shrub called "Jaborandi" are now exported in certain quantity to Germany, where a valuable alkaloid is extracted from them that fetches a very high price in the drug market.

Now in Paraguay this plant (leaves of which I send herewith) exists in such enormous quantities that, even should its richness in alkaloid be less than that from Pernambuco, its cost would be relatively very much less. Indeed it has no value in Paraguay.

The chief virtue as a drug of this "Jaborandi" known in Paraguay is that a decoction from its leaves is the strongest sudorific known.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

SIR, Royal Gardens, Kew, September 8, 1881.

I AM desired by Sir Joseph Hooker to acknowledge the receipt of your letters of September 1st and 5th relating to Mr. G. H. Egerton's reports on certain vegetable productions of Paraguay.

The sample of Jaborandi from this source, and the information regarding it, is of great interest. The drug, although a recent introduction to pharmacy, is one which has attracted much attention. Its commercial source, as Mr. Egerton has stated, is Pernambuco.

Professor Oliver, the Keeper of the Herbarium here, who has looked into the matter, reports that, though the Paraguay and Pernambuco plants are extremely closely allied, it is possible that they are not absolutely identical. The medicinal properties are, probably, however, similar. A portion of Mr. Egerton's sample has been preserved for the Museum of the Royal Gardens; the remainder has been divided between the Pharmaceutical Society, the Professor of Medicine at University College (Dr. Sydney Ringer), and Dr. Michael Foster, the Prælector of Physiology, Trinity College, Cambridge. I will take care to furnish you with any reports which reach us as to its pharmaceutical value.

It would be interesting to have dried specimens in flower of the Paraguayan Ipecacuanha, and also a sample of the drug.

I am, &c.
T. V. Lister, Esq., (Signed) W. T. THISELTON DYER.
Foreign Office.

Prof. SYDNEY RINGER to ROYAL GARDENS, KEW.

15, Cavendish Place, Cavendish Square, W.,
September 24.

MY DEAR SIR,

I ENCLOSE the report on Paraguayan Jaborandi, and, with best regards, remain,

Yours, &c.
(Signed) SYDNEY RINGER.

REPORT on PARAGUAYAN JABORANDI.

THIS specimen is undoubtedly true Jaborandi, but it is far inferior to the Pernambuco Jaborandi, for its physiological action is much less, and it yields much less alkaloid, and apparently this alkaloid is much weaker as a sweater than the alkaloid obtained from the Pernambuco leaves.

Mr. A. W. Gerrard, F.C.S., made the pharmaceutical examination, and I append his report.

"Three estimations were made of the alkaloid in the leaves, and this, converted into nitrate, gave a mean of ·12 per cent. This yield is very small compared with that of other Jaborandis. The nitrate of the alkaloid formed a moist semi-crystalline mass, slightly deliquescent, thus differing from the Pilocarpine of ordinary Jaborandi.

"The leaves are comparatively rich in essential oil. This at present has no commercial value."

The yield of nitrate of Pilocarpine from good commercial Jaborandi leaves is ·33, hence the Paraguayan specimen only contains one-third of that contained in the ordinary commercial Jaborandi. Pilocarpine of commerce contains at least two alkaloids, and only one of these is diaphoretic; and our physiological investigation suggests that the alkaloid derived from the Paraguayan specimen contains but little of the diaphoretic alkaloid.

Mr. S. Stonham, resident house physician at University College, made the physiological investigation. He experimented on himself, as well as on other persons. He employed an infusion of the leaves, the liquid extract, and the alkaloid.

The Paraguayan specimen, like ordinary Jaborandi, causes sweating, salivation, and lachrymation, the salivation in every instance being in excess of the sweating.

Mr. Stonham made three observations with an infusion, using 90, 90, and 120 grains of the leaf respectively; two observations with liquid extract, using ʒij and ʒiij respectively; and four observations with the alkaloid, using $\frac{1}{3}$, $\frac{1}{3}$, $\frac{1}{2}$ of a grain, and 1 grain respectively. The alkaloid was administered hypodermically; 60 to 90 grains of the infused commercial leaf and one-third to one-half of a grain of commercial Pilocarpine produce copious sweating and salivation, lasting from four to six hours, whilst much larger doses of Paraguayan Jaborandi excites far less sweating and salivation, both of which results ceased within an hour.

To a man we gave hypodermically $\frac{1}{3}$ grain of commercial Pilocarpine, and in three minutes he sweated profusely. To the same man on another day we gave $\frac{1}{2}$ grain of Paraguayan Pilocarpine, and this excited only slight perspiration and slight salivation.

This last experiment shows that in the same dose the alkaloid from commercial Jaborandi is much more active than the alkaloid from Paraguayan Jaborandi. This is probably due to the fact that the methods employed extract all the alkaloids. Now Jaborandi yields at least two alkaloids. Probably the non-sweating alkaloid predominates in Paraguayan Jaborandi.

Mr. Gerrard, who probably knows more of the pharmacy of Jaborandi than any other man, tells me that he finds the black leaves yield most alkaloid, but these Paraguayan leaves are thin. Possibly another specimen of thicker leaves might be more efficacious. I certainly suggest that another specimen should be sent over, and I would further suggest that the whole plant of different year's growth should be tested.

SYDNEY RINGER, M.D.

DR. MICHAEL FOSTER to ROYAL GARDENS, KEW.

The leaves were entrusted, for the preparation of the purified alkaloid, to Messrs. Brady and Martin, of Newcastle-on-Tyne. Those gentlemen succeeded in obtaining a small quantity of alkaloid only, and this they were unable to present in a crystalline form, so that no exact statement can be made as to the quantity of alkaloid present in a given quantity of leaves.

The physiological investigation of this alkaloid was entrusted to Mr. J. N. Langley, M.A. of Trinity College. He found that the alkaloid had an action similar to that of Pilocarpine, but differing in some respects. Like Pilocarpine, it gives rise to increased secretion, of saliva, perspiration, &c., and like Pilocarpine, in larger doses it stops secretion; but in this alkaloid the arrest of secretion comes on earlier, *i.e.*, with smaller doses, than is the case with Pilocarpine. Hence, as a drug to promote secretion of saliva, perspiration, &c., the present alkaloid is inferior to Pilocarpine.

But there are reasons for believing that in Jaborandi and in Pilocarpine, as at present prepared, there are two alkaloids, one stimulating secretion and one stopping secretion. If this is the case, and if means are discovered for isolating them, then the value of the leaves under discussion would depend simply on the quantity of the stimulating substance present in them.

Besides this the alkaloid present in these leaves has not so injurious an effect on the heart and vascular system as has Pilocarpine.

The general conclusion at which Mr. Langley and myself have arrived at is, that if the alkaloid were (even approximatively) isolated in the country itself where the leaves are gathered it might be worked profitably even at the present time, though it would not pay to export the leaves to be worked up in this country on account of the smaller quantity which they contain. If pharmaceutical chemists succeed in isolating a stimulating substance and the method prove capable of being employed on a large scale, then these leaves would become very valuable.

Hence, even if it is decided to do nothing with them at present, they should not be wholly lost sight of.

M. Foster.

Trinity College, Cambridge,
October 7th, 1882.

CCIV.—JOURNEY IN NYASSALAND.

The following account of a journey made on the frontier of the British Protectorate of Nyassaland by Mr. John Buchanan, C.M.G., Acting Consul at Nyassa, who has already made botanical collections in the Shiré Highlands, contains references to plants and native industries of an interesting character. The district traversed was along the river Ruo, a tributary of the Shiré river, in a north-easterly direction towards the southern extremity of Lake Nyassa.

Foreign Office to Royal Gardens, Kew.

Sir, Foreign Office, April 6th, 1891.

I am directed by the Marquis of Salisbury to transmit to you herewith, for your information, copy of a despatch from Mr. Buchanan, the Acting British Consul at Nyassa, giving an account of a journey taken by him from Chilomo to Milange.

I am, &c.
(Signed) P. W. Currie.

The Director,
Royal Gardens, Kew.

Mr. Buchanan to the Foreign Office.

My Lord, Chilomo, December 10th, 1890.

With reference to my despatch to your Lordship, No. 48, of the present series, I have now the honour to enclose an account of my journey, which for the greater part lay along the frontier of the British Protectorate of Nyassaland.

The geographical feature most worthy of notice is my discovery of the Zoa Falls, which are situated on the Ruo, about 25 miles inland from Chilomo. The falls are from 150 to 200 yards in breadth and 200 feet in depth.

I trust this account, though imperfect, may be of interest to your Lordship at the present time.

I have, &c.
(Signed) John Buchanan,
Her Majesty's Acting Consul.

Her Majesty's Principal
Secretary of State for Foreign Affairs.

Report of a Journey taken along the Frontier of the British Protectorate of Nyassaland.

Starting from Chilomo our path lay along the right bank of the Ruo for the first 10 miles across an almost perfectly level plain, passing through Chief Mkengwa's principal village Pamlambi, and thence to Doa, Nchacha, Chipolopolo and Ntengera. Owing to the recent Portuguese troubles several villages had been deserted, while on the other hand new villages were being constructed by natives who had crossed from the other side.

A mile inland from the Shiré there commences an extensive belt of Borassus palm, which, varying in breadth from one to nine miles, extends from the Ruo to near Nkati, a distance, including a few broken tracts, of between 35 and 40 miles. Nowhere is the result of the Portuguese invasion more apparent than in the number of those graceful productions of the vegetable kingdom that now nudely stand as if protesting against the barbarous treatment they received at the hands of those ruthless intruders, who beheaded them for their life's blood. Giant Baobabs and tall "Njale" trees stud the plain, and the umbrageous Kigelia is ever present. As one journeys on he comes suddenly upon patches of lawn closely shaven by the incisors of the wary antelope, defined it may be by a fringe of dwarf palm supported by a combination of other trees and shrubs, and the ubiquitous mimosa, which, though unmerciful to the feet of the unshod traveller, not only when in flower entrances the vision by presenting a solid semi-globe of golden blossom, but diffuses around a fragrance such as only prodigally beneficent natûre may indulge in.

Several miles of the plain are densely wooded with the more common types of African forest, Acacia, Bauhinia, Terminalia, Pterocarpus, Tamarindus, &c.; and at the foot of the hills, the forest, if not primeval is certainly virgin. There is here to be had an abundant supply of firewood for river work, but so improvident are the natives, and so destructive their methods of agriculture in deforesting a district, that care will have to be exercised in order to maintain a supply of this article so necessary for river steamers. A very considerable amount of Sesamum is grown by the natives in addition to other crops of cereals along the banks of the Ruo, and it is hoped the acreage will this year be largely increased.

The river abounds in fish, and it is no exaggeration to say, that in some places the water is literally black with shoals of yambo, golokolo, machenga, micheni, msuluwa, mambuli, makambali, and others, all more or less eaten by the natives, and some of which are welcome adjuncts to the white man's cuisine. Men and boys sit for hours at a time in some secluded spot on the river's bank, patiently plying the "gentle art," while others less mindful of sport resort to traps and weirs.

At Mtengera the first of the rocks known as Chichiri are visible. For some distance below this point navigation is difficult, but above it it is impossible. A light draught steamer may ascend the Ruo at all times for several miles, and for several months during the wet season as far as Chipolopolo's, about eight miles, while boats may ply as far as Mtengera nine to 10 miles, during the whole 12 months: but above the rocks no craft can be of use.

At this point the hills commence, and the path still following the course of the river crosses many undulations before reaching the spot where Mlolo from the left bank has chosen to establish himself. The country between Mtengera and Mlolo's, a distance of about five miles, is poor. The various undulations are covered with trees of small growth, the soil is thin and shingly. Near to and about Mlolo's it is different, there being less shingle and more earth.

Chief Mlolo I found awaiting my arrival. Ever since the first visit paid to him at Mongwe by the English he has proved staunchly friendly. Several times during the last 12 months he has requested British protection, and the British flag, which requests, owing to his being on the left bank of the Ruo, could not be entertained. Not to be done, however, and rather than submit to Portuguese sovereignty, he left his country, and crossed into the British Protectorate. This step meant to himself and his people a severe sacrifice, as they had to leave their well-stocked storehouses to Portuguese troops, and live for months on what food they could scrape together from among their Manganja friends.

Mlolo, being a hospitably disposed man, deeply lamented the poverty of his position, in that he had not the means of treating me as he would wish to have done.

I presented him with the British flag, greatly to his delight. His principal village, which consisted of a hundred or more huts, was still in the embryo stage, and before he could enter thoroughly upon the work of the field, he had to present an offering to the spirits of his ancestors. This took place on my return journey, about three weeks after. I was present and witnessed the ceremony. The headmen and elders of the village assembled outside the chief's hut. Two young damsels were seated on the ground, each holding a small basket in her lap. The chief himself officiated as priest. He proceeded to transfer the contents of a flat sieve filled with flour into the small baskets, letting the flour fall gently through his fingers, the while enumerating his wants and desires in a kind of chant, while a principal headman at intervals called out "Wopa, wopa," which was intended for a strong seconding of Mlolo's statements, and was in turn approved of by the elders, who unanimously clapped their hands in full assent. The next part of the ceremony was to adjourn to the banks of the Ruo, where, under a shady tree, an altar had been prepared. This consisted of a few withes stuck into the ground in a circular form, making an enclosure 18 inches diameter by about three feet high, a grass roof for which had been prepared, and lay at hand. The two young damsels were seated as before, the ground within the enclosure was carpeted with a yard of blue cotton cloth, a small earthenware pot was pierced at the bottom and placed in the centre. Mlolo now took the flour in handfuls from each girl alternately, and carefully placing it within the altar by the side of the pot, again enumerated his wants, and beseeched the spirits of his ancestors to look favourably upon him and his people in their new home. The burden of his prayer was that he might be blessed with abundance of ivory and good crops, and as a set off against these requests he brought prominently forward some of his good deeds, chief of which was his loyalty to and preference for the English, as evidenced by his having left his country and some of his kindred rather than be cut off from British connexion.

The flour having been duly deposited in the orthodox way, a vessel of native beer was next brought forward, and as each ladleful was decanted into the receptacle within the altar, he repeated his prayer as before, while the old man at his hand responded "wopa, wopa," and the elders of the assembly repeatedly clapped their hands in a solemn amen. The pot within the altar was now filled, notwithstanding its being perforated, and as the precious liquid streamed from within the sacred precincts, several young men, who had not tasted their beverage since crossing the frontier, voted libations out of place at such a trying time. The priest having notified that they had done their duty to their ancestral spirits reserved a toothful of the beer, which led to a rather unseemly altercation between the assistants, notably,—he whose function it was to call "wopa," and whose throat decidedly needed moistening. The ceremony being over, a general clapping of hands followed, as a grand amen to the whole proceedings; the grass roof was placed over the altar; the calabash used in decanting the beer was hung on a branch of the tree overhead and the company retired. Garden and field operations were soon undertaken in right earnest, and on my revisiting Mlolo's 10 weeks later, many acres of forest had been cleared and planted.

Mlolo's villages extend for several miles below and above that in which he resides, which is situated partly on a promontory jutting into the Ruo, and partly on a knoll lying in the bosom of a crescent-shaped ridge. One tall solitary Borassus palm stands as a landmark of former inhabitants long since gone.

Passing beyond Mlolo's the path follows closely the course of the river. Here and there it crosses belts of meadow, now under an umbrageous tree whose grateful shade invites the traveller to rest, then emerges to the waters' edge, and so on for several miles till it enters upon very rough and stony ground trying alike to tender feet and shoeleather.

At this part of the river its bed is one mass of rocks and boulders, the geological formation of which is beautifully evident. For several hundred yards the appearance of these rocks is as if a shower of snow had fallen on ground already frozen, and had been blown into tiny wreaths of a wavy pattern, this appearance being due to the various strata having a sinuous wavy form, and the rocks themselves polished by the wear and tear of ages.

At Nakale, nine miles above Mlolo's, there is a small village of that chief's people eking out a precarious subsistence. Our friends on the other bank made strenuous efforts to persuade the Nakale people that they had egregiously blundered in leaving Portuguese for British territory, only they would not see it. We found here an intact specimen of the bark canoe used in crossing the river.

Two miles further on you get the first glimpse of the Zoa Falls, another half hour, during which you ascend several hundred feet, and you stand on a level with them, and already begin to feel and to breathe the bracing atmosphere of the mountains. Fifteen minutes more takes you to the village of Nbataombere, which is presided over by a swarthy dame, who placed her best residence at the disposal of the stranger.

For years past I had knownthat the Ruo abounded in miniature falls and cataracts, but until I passed it was not known to Europeans that this charming river, among the sombre recesses of the hills, took a giant leap of 200 feet into a foaming abyss whose depth I had no means of estimating, and which the river itself had formed during bygone ages. I estimate the breadth of the river bed at this point at about 200 yards, while from bank to bank across the face of the fall, the breadth is much more.

The falls of Zoa are about 25 miles inland from the mouth of the Ruo, and at an elevation of between 1,400 and 1,600 feet. The general outline of the fall is that of a horse shoe. Near to the left bank is a chasm some 60 yards long by 30 yards broad and 200 feet in depth to the water level. From this chasm to the right bank the wall is less or more terraced. Above the chasm on the left bank there stands a huge mass of rock, from behind which and down whose face during the wet season pours a gigantic cataract. At the time of my first visit the water from various channels collected into one main stream which thundered down the chasm foaming and furiating between its walls, sending heavenwards clouds of vapour, and in emerging from its confinement dashes itself out into a breadth of 150 yards and continues its angry course impinging on rocks and boulders till reaching Nakale, where it composes itself into dark blue lakelets, tempting indeed to the heated traveller. During the rainy season while the river is full, the water is spread over the full extent of the river bed, and must indeed be a magnificent sight. The face of the falls abounds in several large and many small "pot holes" from 18 inches to 10 feet diameter, and from one to 10 feet deep. I was not fortunate enough to see the water at its work of forming these holes, but the stones lying at the bottom of them, some in the rough, others kidney shaped, others almost round, are conclusive evidence of the water's action.

An Alga common to many of the rocky river beds in Nyassa-land had taken possession of every hole and cranny where it was possible to exist, and liberally carpeted the face of the fall with living green. On the left bank several species of aloes were in bloom, and among the rocks there existed various kinds of succulent plants enjoying the moist atmosphere of the spot. Both banks are well wooded down to the water's edge.

The country around Zoa is composed of hills and ridges, from the top of some of which an extensive view to the east may be obtained. The village of Nhataombere is situated on a level spot between two of these ridges that abruptly terminate at the Ruo, thus ending the series of hills which, commencing at the Murchison Cataracts, follow the course of the Shiré, gradually diverging inland to a distance of 10 miles at the Ruo, forming a wall averaging from 2,000 to 3,000 feet high, probably 70 miles long, and fronting the plateau on which Blantyre, Mandala, and surrounding districts are situated. Among these hills are many hamlets of industrious Manganja, who are great workers in iron, which, in the shape of agricultural implements, finds a ready sale.

For eight miles beyond Nhataombere the road lies through very broken country, till reaching the Zuchila, which, cut up into many channels, forms a river 150 to 200 yards at its confluence with the Ruo. The Zuchila forms the main drain for a very extensive tract of country. Rising on the north-east face of Milanji, it makes a wide detour out into the plain, and passes through much marshy land, collecting supplies from many streams and rivulets, some of which take their rise within a few miles of Blantyre. The country beyond the Zuchila is rather hilly for the first few miles, until reaching the Milanji plain. The road from the Zuchila to Milanji ran through a succession of Wa-nyassa villages, many of which were of quite recent origin, the inhabitants having only lately crossed from the left bank. I was much pleased with the attitude displayed by these Wa-nyassa people. As we reached each hamlet we were presented by the headmen with fowls and flour. The people were delighted with the idea of having been placed under British protection, as it augured for them peace and liberty. The Wa-nyassa, who now inhabit the country from the Zuchila along the right bank of the Ruo to its most easterly affluents in the Milanji Mountains, are the original possessors of the land. They are a peace-loving but weak people, who have been harassed and robbed by the intruding Wa-yao, until now comparatively few remain in distinctly separate districts. Chipoka, recently deceased, who had his principal village on the Mloza, was the representative chief of the district. He was a quiet, well-dispositioned man, who seldom or never took the aggressive. His own hut was situated near to a clump of patriarchal monarchs of the forest, beneath whose sheltering branches, enclosed by a reed fence, are several altars raised to the ancestral spirits of the Wa-nyassa. In times of trial and difficulty the old man often found his way within the sacred enclosure, and might be seen as if in earnest, close communion with those inhabitants of the supernatural world, or making some little offering or performing acts which, if pleasing to the spirits, they would make manifest to Chipoka by assisting him in some of the many forms in keeping with the orthodox African's faith.

The whole district abounds in iron. Every hamlet has its smithy, and to every group of hamlets there is a melting furnace, where the ore is reduced to malleable form. Hoes and axes were in demand, and early morning saw the blacksmith hard at work, while the hammerman, who, body bent, and legs apart, raised a roughly square stone high over his head, and brought it down with herculean force upon the glowing metal, signallised to people afar off that the descendants of Ham are not wanting in the genius of Vulcan.

A villainous Yao chief, Chikumbo, who had previously helped himself liberally to Wa-nyassa territory, set his mind on subjecting the whole tribe to his rule at Chipoka's death. His tactics, however, have been meantime defeated, and it is hoped the Wanyassa may be enabled to live in peace and quietness in their own homes, under the special protection of Her Majesty's Government which they so ardently craved.

The country lying along the bank of the Ruo inhabited by these Wa-nyassa is slightly undulatory, and has a checkered appearance occasioned by large patches of grass land, divided by belts of moderately sized trees. The immediate banks of the Ruo support trees of beautiful trunk and form, and whose dark-green foliage, conspicuously high above the neighbouring forest, limn the course of the river. The prevailing colour of the soil of the district is red, and ferruginous. From the Shiré to Milanji, sorghum forms the staple crop. I passed through fields that had produced marvellously, and I measured sorghum stalks actually 20 feet in length. It would notwithstanding be a mistake to suppose that such fertility is to be found all over. *Cajanus indicus* is also cultivated extensively, and bears profusely, and here at least it almost merits the name of "bean tree." Judging from what I saw of the Milanji plain, it should be a wheat-bearing district, and as it is only slightly undulatory, and is well watered, it would be easily brought under cultivation. It may not be too imaginary to picture this plain before long the home of many happy families in the midst of fields of golden grain.

Having reached Milanji, which can be easily dcne in three days from Chilomo, I was heartily welcomed by the Rev. Robert Cleland, at whose mission station I stayed several days, and transacted certain consular business with chiefs in the neighbourhood. This devoted missionary had purchased a piece of land for mission purposes, built a house and started a school, and the Church of Scotland might fairly claim to have taken possession of Milanji in the name of Christianity. Chikumbo, however, proved so fickle and maintained his aggressive attitude towards the Wa-nyassa to such an extent as to render mission work almost hopeless; the more so as Mr. Cleland had planted his station between Chikumbo and the Wa-nyassa with the double intention of appeasing the former and ameliorating the position of the latter, to whom indeed he rendered much assistance. Pending the advent of a more peaceful state of matters Mr. Cleland and his coadjutor, Dr. Scott, removed to a neighbouring chief under whose friendly ægis they hoped to prosecute their labours, but malarial fever had already told upon

Mr. Cleland's constitution, and a few weeks after my visit he was numbered among those who have laid down their lives for the regeneration of Africa, deeply regretted by all who knew him.

Having completed what political work I had to do I moved north-east to Mount Machemba, and Mr. Cleland accompanied me. The road lay along the base of Milanji. This grand mountain merits description by a better pen than mine. Based upon a plain, 2,000 feet above sea level it rises in lofty grandeur to a height of 8,000 or 9,000 feet, and extends eastwards for a distance of 20 miles, being separated by a narrow path from Mount Cheza, a continuation of whose well-wooded ridges extend to the south of Lake Shirwa, forming the south-easterly ledge of the Shirwa basin. The north face of Milanji, Chambe, confronts you with 6,000 feet of living rock, the south and easterly faces are less perpendicular, and more broken. The home of Manga is a distinct feature of this part of the mountains. Situated at the south-east corner, and slightly apart from the main body of Milanji, it rises to a height of 6,000 or 7,000 feet, and seems to possess an influence in attracting passing rain clouds as the climate in its vicinity is more moist, and actual showers more frequent than anywhere else. The north-east face is well wooded, and in the numerous ravines which proceed from the serrated apex of the mountain may be seen the stately boles of a species of pine tree, which so far as I know is still undescribed. At no remote date all the slopes of Milanje must have been densely wooded. Isolated patches of virgin forest still remain on the eastern faces, but the devastating axe and fire of the natives have worked sad havoc. The district on the whole is well watered. Every ridge has its burn, and large streams are frequent. On the top of the mountain, within a limited area, four rivers, the Lichenya, Likubula, Zuchila, and Ruo, take their rise, the three former discharging into the latter, and all of which are formidable and difficult to cross during the rainy season. The soil is fertile, that at the north-east corner about Chipoka's particularly so. All along the base of the mountains are large patches of wet grass land, capable of producing vast supplies of rice, which at present is a limited article of cultivation. Maize and sorghum are the staple crops. Bananas grow luxuriously. At Chipoka's there are a few orange trees which produce an excellent quality of fruit.

Milanji is peopled chiefly by Wa-yao and Wa-nyassa, the latter being wedged in about the upper affluents of the Ruo between Chikumbo and Metapwiri. The Wa-yao of these parts are well known as inveterate slavers, who still traffic in this nefarious trade.

From Milanji we passed to Mount Machemba, a long day's journey. Machemba is an unpretentious mountain situated on the Shirwa plain about 15 miles south-west of that lake. The Palombe River, which rises in the Cheza range and flows northwards eight miles or so west of Machemba, defines the south-western limits of the Shirwa basin, the Zuchila being the territorial boundary between the respective districts. A great part of the journey was over an uninteresting plain, monotonously level, and already badly off for water. This plain stretches northwards for many miles, and during the wet season is partly under water. During the dry season water supply is a serious question. In the immediate neighbourhood of Machemba it is obtained from wells, and is brackish. The vegetation of the plain is mainly comprised of species of acacia, which seem to thrive anywhere. On the base of the mountain are a few baobabs which indicated connexion with Shirwa, *Erythrina* and genera common to the lowland were also represented, while among the rocks monster euphorbias and yuccas hold possession, and predominate.

The Machemba district is peopled by Anguru, who have their headquarters round the south and south-east corners of Lake Shirwa. The ruling chief is Nyeserera, who, save that his apparel was even more scant than that worn by his subjects, could not be distinguished from them. Though not distinguishable in dress, however, he proved himself a chief in kindliness of heart once he knew that our mission was peaceful. He was delighted, as were all his people, to receive the British flag, and in return for something I gave him presented me with a fat-tailed sheep such as I had never seen before. Nyeserera rules a numerous people who seem to enjoy life to the full. They came in crowds to see the strangers, my friend's donkey proving a great centre of attraction.

As the territory of Nyeserera reached the limits of the Nyassaland Protectorate in a north-easterly direction, the object of my journey was now accomplished, and I returned to Chilomo by a route which for the greater part lay through unexplored bush having no particular features worthy of description.

CCV.—AFRICAN OIL PALM.

(*Elæis guineensis*, Jacq.)

The *Kew Bulletin* for November 1889 (p. 259), contains some account of the Palm Oil industry of West Africa in connexion with the attempt made to introduce it into Borneo. This account may be supplemented by the fuller details extracted from the recently published Report of the Commission appointed in 1887 to consider the promotion of economic agriculture on the Gold Coast. This document contains a great deal of important information upon the principal staples of the Colony, and is understood to have been drawn up by the Vice-President, Mr. W. F. Hutchinson, "a gentleman of local connexion and practical experience," who has himself established and worked an agricultural farm in the neighbourhood of Cape Coast.

Of all the products of the Gold Coast the *Elæis guineensis* is undoubtedly the most important to the native. The fruit supplies him with a favourite food and two important articles of commerce; with the leaf-stalks he builds his house and barn and thatches them with its leaves, and from the stem he extracts a pleasant and (sometimes) intoxicating drink. The tree prefers a moist soil, flourishing in the warm, damp valleys, where it grows in extensive forests. It has never been made the object of systematic cultivation, but, as far as can be ascertained, it begins to bear in its fourth or fifth year, increasing till its fifteenth, and continues to bear at least 60 years. It produces from four to seven bunches of nuts every year. As the "fatness" of the nuts (*i.e.*, the amount of oil contained in the fibre) differs greatly according to soil, the quantity of oil varies from three gallons per year in a moist soil to one gallon in dry. These nuts have a fibrous covering which contains the famous palm oil. Three varieties of the tree are distinguished, having orange, red, and black nuts respectively, the first giving the finest oil but small kernels, the others less oil but larger nuts. When the bunches of nuts are ripe they are cut and thrown into a hole in the ground till a sufficient quantity is collected to be made into oil.

During this time the nuts appear to undergo a small amount of fermentation, and the produce is "hard" oil, the fresh nuts giving "soft" oil which fetches a better price in the European markets. The quality of the "hard" oil is also deteriorated by the dirt which becomes mixed with the nuts while stored, to separate which no care is taken. When a sufficient quantity has been collected the nuts are boiled till the fibre is softened; they are then heaped up in stone troughs specially prepared for the purpose, and beaten with sticks till the fibre is loose. The heap of nuts is then covered with plantain leaves and left for 12 hours, during which time great heat is developed and a quantity of oil runs off. The nuts are then washed in hot water and the fibre separated and squeezed by hand. The oil is then boiled to separate it from the water taken up in the washing.

This process is defective at every stage. To produce the finest quality and the largest quantity of oil the nuts should be treated when just ripe and fresh gathered from the tree. They should not be allowed to ferment, which darkens the colour of the oil and causes it to harden. The separation of the fibre by beating and hand squeezing is slow and gives very imperfect results, and should be replaced by machinery in the first stage and hydraulic presses in the second. At present quite 25 per cent. of the oil is lost, first by imperfect separation of the fibre, a large quantity of which is left adherent to the nuts, and second by want of power in the squeezing, which fails to extract the whole of the oil. Finally, the last boiling further darkens the oil, as palm oil changes colour according to temperature. * * * * *
Pure fresh palm oil has an agreeable smell (it has been described as resembling that of plum cake), and is of a bright orange colour; but the oil of commerce, owing to faults of manufacture, has a stink absolutely indescribable, and every shade of colour between golden yellow and black. In the Western Province the quality is further deteriorated by adulteration. At Salt Pond a peculiar fine red earth is used for mixing by the middlemen. In the Chama district the oil is mixed with over ripe plantains and sour kanki. Accra may be considered the dividing line of the two sorts, the oil made in that district and to the eastward being soft, that made to the westward being hard. The soft oils are in general purer than the hard; these being less able to incorporate foreign substances, the adulteration is almost confined to the mixture of water. * * * * * * *
To show the effect of adulteration nothing more is necessary than to compare the position of Lagos oil (which is the purest known) with that of Gold Coast oil on the European market. When Lagos oil sells for *22l.* 10*s.* per ton, Accra oil (which includes Addah and Quittah sorts) fetches 19*l.* 10*s.*, and Salt Pond (including Winnebah, Appam, and Chama sorts) 18*l.* only, or 20 per cent. less than Lagos sorts. No doubt some of the superiority of Lagos oil is inherent in the article, but having in view the amount of adulteration in the oil from the Gold Coast, it is not unreasonable to expect that the production of a purer oil and the adoption of the Lagos "cold" process of manufacture (as distinguished from the Gold Coast "hot" process) would approximate prices. *
* * * * It is impossible to pass from this subject without referring to the fluctuations in the price of palm oil which have occurred during the last few years. * * * * *
It is the difficulty of transport that keeps the price on the Gold Coast at such a height as renders the present state of the markets in Europe unprofitable to the exporter, although the grower can produce it at a cost which would enable him to sell it with profit at 3*d.* to 4*d.* per gallon. Allowing 300 gallons to the ton, the cost to the exporter would

be 3*l.* 15*s.* to 5*l.* per ton, which, after paying for caskage, shipping, &c., and allowing 1*l.* per ton for transport from the plantation to the beach, would enable him to place it on the European market at 13*l.* per ton. In view of the increasing use of other fats, displacing palm oil in many directions, the inhabitants of the Colony have to face the probability of the price of palm oil touching 15*l.* to 14*l.* per ton, and have the right to call upon their Government to perform its obvious duty by putting the roads in such a condition as to enable them to transport their produce at a reasonable cost, and to prevent their staple produce being driven from the market to the ruin of their trade. After the manufacture of the oil the nuts are still valuable, as they contain the well-known palm kernels. For every ton of palm oil there should be 2½ tons of clean palm kernels, and yet we find that the exports of this article are much below those of the oil. The direct loss to the Colony is enormous, and arises from the same causes as diminish the export of oil. Machines have been invented by Gunnell and others for the purpose of rapidly breaking the nuts, but they can never come into general use until it is possible to move large weights in carts along roads adapted to the purpose, as will be evident when it is considered that under present conditions four men are required to carry, on their heads, sufficient nuts (2 cwts.) to produce 56 lbs. of kernels, the value of which varies from 1*s.* 9*d.* to 2*s.* 3*d.* Owing to this cause 100,000*l.* worth of this one article are annually wasted. The palm kernels are exported to Europe, where the oil is extracted, but this might be done on the Coast if it were possible to put oil mills on the plantations or to convey nuts cheaply to central mills, and would probably be found more remunerative than the exportation of the kernels. The average yield of the kernels being 30 per cent. of their weight in oil, the utilisation of the whole estimated crop would produce 8,700 tons of oil per annum, which at the price of cocoa-nut oil (which it closely resembles) would be worth to the Colony over 175,000*l.* To this must be added the value of the cake after the expression of the oil. The brown or black oil made by the process now in use in the country is not worth exporting, as it can be only slightly bleached, and is therefore useless for soap-making.

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 56.] AUGUST. [1891.

CCVI.—ORCHID NOMENCLATURE.

It seems desirable to state the position of Kew with regard to orchid nomenclature. In no other country are pains and money so lavishly expended on the cultivation of the plants of this family as in England. In no other country are so many species to be found in a living state as in our private collections. And a large capital is invested in the commerce by which these collections are supplied.

It is the business of botanical science to furnish such plants with names under which they can be recognised, and with technical descriptions, by means of which the names can be fixed and the plants identified. For this purpose it is necessary that a standard of nomenclature should be maintained by some competent authority. During the

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and,
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
88 and 90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Twopence.

middle of the present century this function was performed by the well-known botanist, Dr. Lindley. After his death, his admirable private herbarium of orchids, amounting to 3,000 sheets, was purchased in 1865 by the Government for Kew. In 1863 Dr. H. G. Reichenbach was appointed Professor and Director of the Botanical Gardens at Hamburgh, and from that time made the study of orchids the scientific business of his life. He was speedily recognised as occupying the place of Lindley, and cultivators of orchids in all countries were in the habit of sending their specimens to Hamburg, for identification and determination. Meanwhile, Kew had continued to amass what is, on the whole, probably the largest comprehensive herbarium of these plants. It was Professor Reichenbach's custom to spend in most years a few weeks at Kew, and he had the opportunity of examining and, in some cases, of describing the new accessions.

He was, however, in the habit of describing the novelties sent him by correspondents from English collections in the pages of the *Gardeners' Chronicle*, and of these, for the most part, no other record exists at Kew. Thus in the genus *Dendrobium* about 160 species are represented in the Kew Herbarium by names above; and in *Epidendrum* as many as 200.

The defect of Professor Reichenbach's method was that he never brought the scattered work of his life to anything like a comprehensive review. To a certain extent he had the clue to it himself, but when oppressed with failing health in the latter years of his life, he seems to have become in some degree overwhelmed with the enormous amount of material which he had accumulated. And it is now ascertained that he often described the same species more than once under independent names. There is the further difficulty that he was not a felicitous expert in the art of describing plants, and from his bare descriptions alone it is often all but impossible to identify the species which he had in view.

This difficulty would not have been considerable if, after his death in 1889 he had, as was confidently expected he would do, left his herbarium to some public institution where it would be open to the inspection of those who took up his work. For reasons on which it is easy to speculate but for which it is difficult to account, he bequeathed his collections to the Imperial Hof Museum at Vienna, on the condition that they should be sealed up for 25 years.

This singular provision undoubtedly placed the "orchid-world" in a rather cruel position. Reichenbach was no longer available to give them names; and his herbarium was not accessible to ascertain what he had done in the past. To this no one having an unnamed orchid in his hands possessed very much in the way of a clue. Nevertheless something had to be done, and amateurs of orchids turned to Kew for help. It seemed a proper part of the functions of the national botanical establishment to render all the assistance in its power as regards the solution of purely botanical problems.

Kew was not, as will have been seen, on the whole badly equipped for the task. In the first place it possessed Lindley's collections, the classical starting point of systematic orchidology. Next, Mr. Bentham had devoted two years at Kew to the elaboration of the family for *Bentham and Hooker's Genera Plantarum.* This was published in 1883. Bentham thoroughly sorted the copious material at Kew into genera, which he defined on a clear basis. Reichenbach's work upon various collections preserved at Kew, which he described and published, is of course available here. Moreover, Sir Joseph Hooker during

1888–90 thoroughly worked out the orchids of India, amounting to about 1,300 species (in 113 genera) for the fifth volume of his *Flora of British India.* Not to speak of other countries, the collection of South Africa orchids is pronounced by Mr. Bolus, F.L.S., their most recent monographer, to be the most complete in existence. The Kew collection of living orchids now amounts to 1,400 species, the nomenclature of which is all carefully determined; the most recent enumeration of the number of existing species is that of Sir Joseph Hooker, who puts them at 5,000.

On the whole Kew probably stands in a better position to serve as a standard of orchid nomenclature than any other botanical establishment. The only real difficulty in its way is how to deal with Reichenbach's indeterminable descriptions and nomenclature. Various correspondents have, however, rendered very useful assistance in filling up this gap by the communication of specimens from living plants which Reichenbach had named. Much more might be done in this direction, and in time it can hardly be doubted that the vast proportion of Reichenbach's types might be recovered.

There is, however, always the risk that when an unnamed orchid cannot be run down in the Kew Herbarium it may not really be undescribed but may be lurking somewhere with a name in Reichenbach's collections. This, however, is a problem which, for the next quarter of a century, cannot be solved. For practical purposes it has therefore been decided to assume that such an orchid is new and to describe it with an appropiate name. This task has been entrusted to Mr. Rolfe, one of the assistants in the Kew Herbarium; and as the work will be done in official time, the descriptions will be published from time to time in the *Kew Bulletin.* It must be the aim of every botanist to avoid the multiplication of names and the piling up of synonyms. But the world cannot wait on posterity, and some one, a quarter of a century hence, may have the patience to disinter from Reichenbach's Herbarium, if it is thought worth while, any names which have the prescription of priority. If, even so astute and experienced a botanist as Sir Joseph Hooker, found himself unable to penetrate the mystery which surrounds many of Reichenbach's names and descriptions, it seems scarcely worth while attempting to rescue them from the oblivion into which for the present they must fall.

Shortly after Professor Reichenbach's death the Royal Horticultural Society appointed a Standing Committee to endeavour, amongst other objects, to maintain some standard of uniformity in orchid nomenclature. The following correspondence is published as defining the position taken by Kew in the matter:—

Royal Horticultural Society to Royal Gardens, Kew.

Royal Horticultural Society,
117, Victoria Street, S.W.,
26th August 1889.

Sir,

In pursuance of a resolution passed at a special meeting the Council of this Society have appointed a Committee to draw up “the “rules which they consider should be followed in the naming of “orchids” for garden purposes. I was requested to act as hon. sec. pro tem, and, in that capacity, to request you to be so good as to nominate one member of your staff to act on the Committee. The keeper of the Botanical Department of the British Museum will also be asked to name a member. It is probable that no meeting of the

Committee will take place till the end of the recess, but, in the meantime, I shall be glad to learn your views on the subject, and to receive any communication for the Committee with which you may be inclined to favour it.

I am, &c.

The Director, (Signed) MAXWELL T. MASTERS.
Royal Gardens, Kew.

ROYAL GARDENS, KEW, to ROYAL HORTICULTURAL SOCIETY.

SIR, Royal Gardens, Kew, 26th August 1889.

I HAVE the honour to acknowledge the receipt of your letter to hand this morning, in which you inform me that the Council of the Royal Horticultural Society have appointed a Committee to draw up the rules which they consider should be followed in the naming of orchids for garden purposes, and requesting me to name one member of my staff to act on the Committee.

2. In anticipation of this action on the part of the society, I have already communicated to the *Gardeners' Chronicle* my views upon the subject. It appears to me that there are two entirely different questions involved.

i. The determination of the systematic position, *i.e.*, the genus and species of orchids as they exist in nature, uninfluenced by cultivation, and without reference to those variations in size, colour, and texture, which, though of very great horticultural importance, are not for the most part taken note of by botanists. This is purely scientific work, which can only be carried on with the resources of a herbarium and library by experts who have given careful study to the subject. I have already publicly stated that I am prepared, as far as the resources of this establishment will allow, to name orchids on precisely the same footing as all other plants not coming within the designation of florists' flowers. I may add that the assistance of this establishment in the matter has already largely been taken advantage of, with, I think, mutual benefit to horticulturalists and to Kew. I do not, however, see how this branch of the work could be in any way aided by the deliberations of a committee, or that anything would be gained by a member of the Kew staff attending them.

ii. The establishment of a definite system of nomenclature for cultural strains of ascertained species of orchids. This is a task of great importance which the proposed Orchid Committee is well qualified to take up. But the principles of botanical classification have nothing to do with the matter, and botanists should in my judgment not meddle with it. It appears to me that orchid growers will create their own standards of excellence with regard to the cultivated varieties of orchids, just as with any other florists' flowers. Such a standard will be a matter of taste and judgment but not of science, and horticulturalists are entitled to name on a purely horticultural basis any form which they wish to recognise as distinct, when they have secured adequate evidence of its permanence. It appears to me that the proper precedent to follow is that of the Narcissus Committee. Such forms should be distinguished by vernacular names so that they may no longer be confused with botanical varieties, and the Committee should register such names as having its authority, accompanying the name in each case with such distinctive marks as may serve to define it.

3. In the work of the Committee as above defined, I do not see that any member of the Kew scientific staff could give any effective assistance. I must further point out that our officers are already hard-worked; and the absence on extraneous duties of those who work during prescribed official hours is contrary to the regulations of the Civil Service.

I am, &c.
Dr. Masters, F.R.S., (Signed) W. T. Thiselton Dyer,
117, Victoria Street, S.W. Director.

CCVII.—NEW GARDEN ORCHIDS: DECADE 1.

1. **Physosiphon guatemalensis**, *Rolfe*, *n. sp.* — Folia oblonga, brevissime bidentata, carnosa, basi attenuata, 1¼–1½ poll. longa, 7–8 lin. lata; petiolus ½ poll. longus. Racemi 3–4 poll. longi, graciles, 12–16 flori. Bracteæ spathaceæ, acutæ, carinatæ, 2 lin. longæ. Pedicelli 3 lin. longi; flores 3–3½ lin. longi. Sepala oblonga, apiculata, arcte carinata, carnosa. Petala obovata, obtusa, glabra, ½ lin. longa. Labellum valde carnosum, 1 lin. longum, læviter trilobum, basi attenuatum, lobo medio oblongo obtuso obscure crenulato, lobis lateralibus parvis erectis rotundatis. Columna alata.

A small species which appeared with *Odontoglossum grande*, Lindl., from Guatemala, in the Glasnevin Botanic Garden, and was sent to Kew for determination by the Curator, Mr. F. W. Moore, in June 1890, and again during the present year. It is nearly allied to *P. Loddigesii*, Lindl., but is smaller in all its parts, especially in the much shorter tube of the sepals. The sepals are deep yellow; the petals light maroon purple, the lip somewhat darker, and the column light green with broad maroon-purple wings.

2. **Bulbophyllum denticulatum**, *Rolfe*, *n. sp.*—Pseudobulbi subdistantes, tetra-v. pentagoni, 1¼ poll. longi, 1 poll. lati, diphylli. Folia lineari-oblonga, obtusa, 3–3½ poll. longa, 5–8 lin. lata. Scapus erectus, gracilis, 5 poll. longus. Racemus subdeflexus, multiflorus. Bracteæ ovatæ, subacutæ, 1½–2 lin. longæ. Sepala coriacea, ovata, acuminata, carinata, 3 lin. longa; lateralia subobliqua. Petala membranacea, elliptico-ovata, mucronulata, minute denticulata, 2 lin. longa, nervo medio valido. Labellum carnosum, lineari-oblongum, obtusum, glabrum, 2 lin. longum. Columna brevis, alis oblongis acutis submembranaceis.

A small species, native of Sierra Leone, sent to Kew for determination by Mr. James O'Brien, of Harrow-on-the-Hill, Middlesex, in May 1891. It has the habit of *B. flavidum*, Lindl., from the same country, but is quite different in numerous structural details. The flowers, which are borne in a somewhat drooping spike, are about three lines long, the sepals of a pale purple-brown tint; the petals white, with a very strong purple midnerve, and very narrow purple margin; and the lip orange, except a narrow pallid greenish-brown area down the centre, which is narrowly bordered with maroon-purple. The petals are minutely but very distinctly denticulate, whence the specific name is derived.

3. **Bulbophyllum nigripetalum**, *Rolfe*, *n. sp.*—Pseudobulbi approximati, late depresso-ovoidei, 6 lin. longi, 8 lin. lati, pallide virides, monophylli. Folia lanceolato-linearia, obtusa, circa 3 poll. longa, 5 lin.

lata. Scapus erectus, gracilis, 6–10 poll. longus. Racemus multiflorus, subsecundus. Bracteæ lanceolatæ, acutæ, carinatæ, $\frac{3}{4}$ lin. longæ. Sepalum posticum oblongum, obtusum, ciliatum, $2\frac{1}{4}$ lin. longum, $\frac{3}{4}$ lin. latum; sepala lateralia paullo latiora, mucronulata. Petala obovato-oblonga, obtusa, arcte ciliata, 1 lin. longa. Labellum valde carnosum, anguste oblongum, obtusum, ciliatum et breviter pubescens, 2 lin. longum, basi canaliculatum. Columna brevis, alis latis subacutis.

A most distinct species, first sent to Kew for determination by Mr. James O'Brien, of Harrow-on-the-Hill, Middlesex, in May 1889, and again during the present year. It is said to have been imported by Messrs. F. Sander & Co., of St. Albans, from the West Coast of Africa. It has somewhat the habit of the preceding, but the scape is longer, and the flowering part more erect. This, as well as the ovaries, is of a light glaucous green. The flowers are under three lines long; the sepals pale yellowish white, with three to five light maroon lines; the petals and lip of the darkest purple-black; and the column pale greenish, with purple margins and teeth. The name is given in allusion to the very unusual colouring of the petals and lip, the latter being in reality a modified petal.

4. **Megaclinium Clarkei**, *Rolfe, n. sp.* Rhizoma validum, repens. Pseudobulbi 2 poll. distantes, late oblongi, acute tetragoni, 1 poll. longi, $\frac{3}{4}$ poll. lati, diphylli. Folia oblonga, obtusa, $2\frac{1}{2}$–$2\frac{3}{4}$ poll. longa, $\frac{3}{4}$–1 poll. lata. Scapus $6\frac{1}{2}$ poll. longus. Rhachis falcato-ensiformis, obscure crenulata, circa 4 poll. longa, 4 lin. lata. Bracteæ triangulares, acutæ, reflexæ, $1\frac{1}{2}$ lin. longæ. Sepalum posticum subulato-lineare, subacutum, scaberulum, 4 lin. longum. Sepala lateralia falcato-ovata, acuminata, breviora. Petala falcato-linearia, obtusa, 2 lin. longa. Labellum recurvum, basi ovatum, subintegrum, apice lineare, obtusum. Columna brevis, apice quadridentata.

Sent to Kew for determination in May of the present year, by Major Trevor Clarke, of Welton Place, Daventry, with the information that it is a native of West Africa. It is allied to *M. oxypterum*, Lindl., but has more acutely-angled pseudobulbs, and more distant flowers, which present various structural differences. The rhachis is light green along the centre with numerous purple-brown spots, and almost with the latter colour near the margins. The sepals are light green below, spotted with blackish-purple, wholly blackish-purple above; the petals maroon-purple; the lip whitish-green, densely spotted with blackish-purple; and the column of the latter colour with a light green disc near base.

5. **Megaclinium leucorhachis**, *Rolfe, n. sp.*—Rhizoma validum, repens. Pseudobulbi ovoideo-oblongi, acute tetragoni, $2\frac{1}{2}$ poll. longi, $1\frac{1}{4}$ poll. lati, monophylli. Folia lineari-oblonga, obtusa, 6–7 poll. longa, 1 poll. lata. Scapus erectus, 6–7 poll. longus. Rhachis falcato-ensiformis, obscure crenulata, circa 3 poll. longa, 4 lin. lata, albidula. Bracteæ ovatæ, obtusæ, reflexæ, $2\frac{1}{2}$ lin. longæ. Flores lutei, velutini. Sepalum posticum subulato-lineare, acutum, $3\frac{1}{2}$ lin. longum. Sepala lateralia semi-ovata, falcata, acuminata, duplo breviora. Petala falcata, linearia, acuta, $2\frac{1}{2}$ lin. longa. Labellum recurvum, basi latum, fimbriatum, apice lineari-oblongum, obtusum. Columna brevis, apice breviter quadridentata.

A most distinct species, sent to Kew for determination by Sir Trevor Lawrence, Bart., M.P., of Burford Lodge, Dorking, in May 1890. Nothing is recorded of its habitat, but no doubt it is a native of some part of Africa. The rhachis is nearly white, with a very faint tinge of yellowish green, and as in this feature it presents so strong a contrast with every other known species the character is commemorated in its name. The flowers are deep yellow, and the bracts brownish. It appears to be more nearly allied to *M. oxypterum*, Lindl., than any other.

6. **Pholidota repens**, *Rolfe, n. sp.*—Rhizoma repens, articulatum, elongatum, subcylindricum, 1½–5¼ poll. longum. Folia oblanceolata, petiolata, 3–4 poll. longa, ¾–1 poll. lata; petiolus ½ poll. longus. Scapus brevis, arcuatus; racemus circa 12-florus, recurvus, flexuosus. Bracteæ suborbiculares, obtusæ, 6 lin. longæ. Pedicelli 3 lin. longi. Sepalum posticum late ellipticum, obtusum, concavum, 3½ lin. longum. Sepala lateralia paulio angustiora, læviter carinata. Petala elliptico-oblonga, obtusa, plana, 1½ lin. lata. Labellum cymbiforme, basi nervis 5 crassis basi lamellatis, apice biauriculatum, reflexum, auriculis suborbicularibus. Columna oblonga, apice breviter quadridentata; rostellum rostratum, acuminatum.

Sent to Kew for determination by Mr. J. O'Brien, of Harrow-on-the-Hill, in June 1890, and again during the present year. It is a native of the hills of India, but the precise locality cannot be ascertained. The prostrate stems creep among the moss, and produce short racemes of light flesh-pink flowers, the disc of the front lobe and apex of the side ones being yellow. There are five thickened plates in the hollowed base of the lip, with an additional very short one on either side. It is nearly allied to *P. Griffithii*, Hook. f., of which it may ultimately prove to be an unusually procumbent variety with differently coloured flowers.

7. **Epidendrum mooreanum**, *Rolfe, n. sp.*—Folia linearia, obtusa, 1 ped. longa, 9–10 lin. lata. Panicula parce ramosa, laxa, ramis aspero-verrucosis. Bracteæ reflexæ, rigidæ, late ovatæ, subobtusæ, 1 lin. longæ. Ovarium pedicellatum aspero-verrucosum, ¾–1 poll. longum. Sepala lanceolato-linearia, subacuta, 7 lin. longa, patentia v. reflexa. Petala oblanceolata, subobtusa, subæqualia. Labellum profunde trilobum, 5 lin. longum; lacinia mediana late elliptica, obtusa, undulata; laciniis lateralibus multo brevioribus subspathulatis; disco medio bilamellato, basi quinquecarinato. Columna clavata, quadridentata.

A species of the section *Encyclium*, belonging to Lindley's group *Hymenochila obtusa aspera*, allied to *E. stellata*, Lindl., but readily distinguished by the unthickened veins of the front lobe of the lip, by the colour and other characters. It was first sent to Kew by Mr. F. W. Moore, Curator of the Royal Botanic Garden, Glasnevin (after whom it is named), in May 1889, and afterwards by Mr. W. Bull, of Chelsea, Messrs. Hugh Low & Co., of Clapton, and by Sir Trevor Lawrence, Bart., M.P., of Burford Lodge, Dorking. A search through the 200 or more species described since the publication of Lindley's *Folia Orchidacea* has not resulted in the discovery of any description which applies to the present species. The segments are pale green with a few dusky markings, and the lip deep purple, the front lobe broadly, and the side ones narrowly, margined with very light green. The flowers are deliciously fragrant. Messrs. Low state that it is a native of Costa Rica.

8. **Polystachya bulbophylloides**, *Rolfe, n. sp.* — Planta minuta, habitu Bulbophylli. Rhizoma gracile, repens. Pseudobulbi 6 lin. distantes, ovoideo-globosi, 3 lin. longi, diphylli (an semper?). Folia elliptica, breviter bidentata, subcarnosa, 4 lin. longa, 2 lin. lata. Scapi ad latera pseudobulborum erecti, graciles, 1¾ poll. longi; racemi circa 5-flori. Bracteæ ovato-orbiculares, minute mucronulatæ, subcarinatæ, 1¼ lin. longæ. Flores subsessiles, carnosi, 3 lin. longi. Sepalum posticum ovatum, subacutum; sepala lateralia obliqua, paullo latiora. Petala ad tuberculum minutissimum reducta. Labellum obscure

trilobum, elliptico-oblongum; laciniis lateralibus parvis obtuse rotundis, lacinia mediana apice arcte recurva obtusa, disco lævo. Columna brevis, dentibus minutis.

A minute and very anomalous little species, native of the West Coast of Africa, sent to Kew for determination by Mr. J. O'Brien, of Harrow-on-the-Hill, during July of the present year. It is precisely like a small Bulbophyllum in habit, having rigid creeping rhizomes on which are borne small ovoid pseudobulbs at intervals of half an inch distant, with a pair of small fleshy coriaceous leaves, and a lateral scape, quite unlike any *Polystachya* in the Herbarium. The flowers, however, agree in structure with that genus, except that the petals are reduced to a minute fleshy tubercle,—another anomalous character, but one which is insufficient to exclude it from the genus. The flowers are white, except a large orange blotch at base of lip, a similarly coloured tubercle at extreme apex, and the stigma, clinandrium, and teeth of the column all margined with light purple.

9. **Renanthera imschootiana**, *Rolfe, n. sp.*—Folia lineari-oblonga, breviter biloba, 4 poll. longa, 9 lin. lata. Pedunculus axillaris, 1 ped. longus, racemus circa 8-florus. Bracteæ semiorbiculares, 1 lin. longæ. Pedicelli 1 poll. longi. Sepalum posticum oblanceolato-subspathulatum, obtusum, subconcavum, 9 lin. longum; sepala lateralia unguiculata, oblique elliptico-ovata, obtusa, undulata, 1 poll. longa, 8 lin. lata, unguis 4 lin. lata. Petala subspathulato-linearia, obtusa, 6 lin. longa. Labellum 3 lin. longum, trilobum; lacinia antica recurva, ovato-orbicularis, obtusa, apice concava; laciniæ laterales erectæ, triangulares, obtusæ, basi breviter auriculatæ; calcar conico-saccatum; discus septemtuberculatus. Columna brevis, truncata, subteres, alis obsoletis.

A showy species, allied to *R. coccinea*, Lour., and *R. Storiei*, Rchb. f., sent to Kew by M. A. Van Imschoot, of Gand, Belgium, during July of the present year, with the information that it was imported by Messrs. F. Sander & Co., of St. Albans, probably with *Aerides Godefroyæ*, as it was received with that plant. The colours are brilliant; dorsal sepal reddish-buff; petals buff-yellow, with small red spots on the lower half and larger ones near apex; lateral sepals reddish vermillion; lip light yellow, with a pair of crimson spots near base; the side lobes and small basal auricles reddish-crimson; front half of central one barred with the same colour, and some orange about the middle of the crest. This organ is very complex, and consists of a pair of contiguous parallel plates in front of the mouth of the spur, then a pair of arcuate crenulate ones, diverging upwards, and finally three erect tubercles at the base of the front lobe of the lip. It is readily distinguished from *R. coccinea* by the shorter segments, the broader lateral sepals, and different details of the lip. *R. Storiei*, according to the description, differs in numerous particulars, and, like *R. coccinea*, its flowers are borne in branching panicles.

10. **Pelexia olivacea**, *Rolfe, n. sp.*—Radices crassi, fasciculati. Folia radicalia longe petiolata; limbus subcordato-ovatus, obtusus, 3–4½ poll. longus, 1½–2¼ poll. latus; petiolus 3–6 poll. longus. Scapus ¾–1 ped. altus, basi squamis vaginatus, apice pubescens. Racemus 3–4 poll. longus, multiflorus. Bracteæ lineares, acuminatæ, pubescentes, 8–12 lin. longæ. Ovarium pubescens. Sepala pubescentia; lateralia linearia, acuta, 5 lin. longa, basi in appendicem calcariformem 5 lin. longam producta, ovario fere omnino connata; sepalum posticum lanceolato-oblongum, obtusum, 5 lin. longum. Petala membranacea subobliqua, subspathulata, acuta. Labelli limbus late ovatus, obtusus,

reflexus, fere 2 lin. latus. Columna 4 lin. longa, rostellum subulato-aciculare, 1 lin. longum.

This species is a native of some part of the Andes, whence it was sent to Messrs. Charlesworth, Shuttleworth, & Co., of Heaton, Bradford, by Mr. E. Klaboch. A plant was presented to Kew in April 1890, where it flowered about a year later. The leaves are dull olive-green in colour, with a broad irregular silvery band on either side, between the mid-rib and margin. The scape, ovary, and sepals are also olive green, and pubescent; the petals pellucid white; the limb of the lip, also the tube formed by the union of the unguis of the lip with the column, is white, the mouth of the same being light yellow. There is a specimen in Dr. Lindley's *Herbarium*, collected by Fendler, near Tovar in Venezuela, which so closely resembles the present species that it will probably prove to be a form of the same. A note describes the leaves as dark green. The structure of the flowers in this genus is very remarkable, and not always correctly described from dried specimens. The claw of the lip is united to the sides of the column, forming a tube, which is produced behind inside the spur of the lateral sepals almost to the latter's free apex, and there terminates as a pair of free linear processes. This tube contains much nectar, and the pollinia are situated just at its apex.

CCVIII.—ARTIFICIAL COFFEE BEANS.

The manufacture of artificial coffee beans has apparently assumed some importance in the United States. Specimens of these spurious beans have been obligingly communicated to the Museums of Economic Botany at Kew by Dr. Brown Goode, Assistant Secretary of the Smithsonian Institution at Washington D.C. The idea of preparing artificial coffee beans for the purpose of mixing with genuine beans for sale in the unground state is, however, not entirely new. In April 1860, the late Dr. Lindley, F.R.S., presented to the Kew Museums some very carefully modelled beans, believed to be made from finely powdered chicory. There is no indication as to the country whence these were obtained. The American beans are supposed to be composed of rye flower, glucose, and water. They are prepared to resemble in size and colour a moderately good sample of roasted coffee beans. By the introduction of a few genuine beans they are made to possess the aroma of true coffee. The modelling is sufficiently good to deceive the ordinary public, but if the beans are at all critically examined it is noticed that the groove on the flat surface is broad and shallow and it does not extend into the heart of the bean by a narrow long slit as in the natural product. Also there is no trace of the silver skin at the mouth of the slit. In other respects the artificial beans very closely resemble true coffee. They are made to vary slightly in size and colour, some are frayed or broken at the edge, and the general characteristics are those of a fair coffee with small and somewhat broken beans.

The introduction of spurious coffee beans as an article of commerce in the United States is thus described in an article from the *New York World*, reproduced in the *Board of Trade Journal*, 1890, p. 448:—

"The average bulk of the genuine coffee imported into the United States is 8,000,000 bags, or 130,000,000 pounds per annum. Experts estimate that fully 20 per cent. of the coffee sold to consumers is bogus, which raises the consumption to 216,000,000 pounds. Taking 30 cents per pound as the average retail price, the people of America pay 65,000,000 dollars every year for this one article of food, of which 13,000,000 dollars is paid for roasted and ground beans, peas, rye, or a manufactured article in no way resembling the Brazilian berry. To this must be added the production and sale of what are called "coffee substitutes." So extensive is this business that it is quite safe to say that consumers pay 12,000,000 dollars for what they believe to be cheap coffee. This raises the total expenditure to 77,000,000 dollars, and it represents a sale of 276,000,000 pounds, for the "substitute coffee" usually sells at 20 cents per pound. It will thus be seen that 96,000,000 pounds of bogus coffee are sold in the United States every year, and some estimates place it at 120,000,000 pounds. Taking the lowest figures, 25,000,000 dollars are received for substances which can be profitably placed on the market at six cents a pound. The manufacturers, therefore, receive 6,000,000 dollars for their goods, while retailers gain a profit of 18,000,000 dollars. There are two kinds of bogus coffee, an imitation bean and the ground article. The bean is the most difficult to produce, and it is only recently that actual success in this direction has been attained. The bogus bean must not only look like the genuine berry when raw, but it should be capable of taking a proper colour when roasted. A very good specimen is now manufactured in Philadelphia and Trenton, being composed of rye flour, glucose, and water. The soft paste is then moulded and carefully dried. To the eye of an expert, the presence of this imitation is easy of detection, and it cannot be used to any great extent among wholesalers. But when coffee goes to the retailer adulteration begins. Sometimes the retailer is deceived, but nine times out of ten he is the one who introduces adulteration. The ground article is very easily produced for a proper colour and infuse an aroma by strong decoctions of coffee essence."

"When mixed with real coffee even the expert eye and tongue may be deceived, while to the ordinary consumer it seems to be the genuine product. Bogus coffee beans have only a slight resemblance to the natural berry, for though they possess proper form the cicatrice on the inner face is too smooth. Then, again, the grey colour of the raw bean is not quite up to the mark, but when these manufactured beans are roasted with 5 per cent. of genuine coffee they find a ready sale. These bogus beans can be made at a cost of 30 dollars per 1,000 pounds, and when mixed with 50 pounds of pure coffee the whole 1,000 pounds cost 37·50 dollars, or 3¾ cents per pound, so that a profit of nearly 100 per cent. is the result. There are any number of "coffee substitutes," the Hillis variety being the most successful. This company is already manufacturing 10,000 pounds per week, it being sold by the barrel to retailers in nearly all of the New England, Middle, and Western States. The profits of this concern are supposed to be 300 dollars per day, and its operations have reached such a scale that the stockholders were recently offered nearly 1,000,000 dollars for their secret and business, but it was declined. No one accustomed to coffee drinking would imagine that a decoction of this stuff was like either Mocha or Rio, but when mixed with four times its bulk of genuine coffee only an expert could detect the imposition. The manufacturers of these "coffee substitutes" claim that they are not violating the law of adulteration of food products because they do not sell their goods as coffee, but simply as a substitute. While this may be true it does not apply to the retailer, who mixes the bogus stuff with good coffee, and sells the whole as the genuine article. Though manufactories may be beyond the penalties of the adulteration law they should be suppressed, for without them coffee adulteration by retailers would be impossible. When it is remembered that American people are compelled to pay 25,000,000 dollars for ingredients that can be manufactured for one-fifth the sum received by coffee growers, the necessity for the suppression of this nefarious trade is apparent. Oleomargarine cannot be sold as butter, neither should "coffee substitutes" be made to masquerade under the name of Java, Mocha, or Rio."

SMITHSONIAN INSTITUTION to ROYAL GARDENS, KEW.

United States National Museum, Washington,
March 30, 1891.

DEAR MR. THISELTON DYER,

I TAKE pleasure in informing you that I have succeeded in obtaining samples of bogus coffee for which you expressed a desire in your letter of January 17. I have sent them forward to you through the Smithsonian Bureau of International Exchanges.

Wesley and Son will notify you of their receipt, and transmit them to you.

I am, &c.
(Signed) G. BROWN GOODE.

W. T. Thiselton Dyer, Esq., C.M.G., F.R.S.,
Royal Gardens, Kew.

The production of artificial coffee has also received some attention in Germany. According to the *Magdeburgische Zeitung* (quoted in the *Board of Trade Journal*, March, 1891, p. 301), an Imperial decree has been issued in Germany forbidding the manufacture and sale of machines for producing artificial coffee beans, which certain German newspapers have of late been extensively advertising, and which have attracted the notice of the Government, as contravening the food law. These beans are not intended to supply by themselves a beverage which, from similarity of taste or effect, might form a substitute for coffee, and cannot therefore be looked upon as such, but are intended to be used in trade for mixing with the genuine article. It has been a question of directing much energy towards the discovery of some cheap compound with the undeniable object of deceiving the public. In the meantime the sale of such compound is not to be prohibited, provided it be known by such a name as will exclude all possibility of deception.

It will be noticed, however, from the following despatch received at the Foreign Office from Her Majesty's Chargé d'Affaires at Berlin the production of artificial coffee beans in Germany has been prohibited by law, and no samples have so far been obtainable from that country.

The Hon. P. H. LE POER TRENCH to FOREIGN OFFICE.

MY LORD, Berlin, June 30, 1891.

WITH reference to your Lordship's despatch, No. 32 of this series, of the 8th of April last, I have the honour to report that I have made inquiries in this city, as well as in other places throughout

Germany, but, so far, have not succeeded in finding any of the artificial coffee beans the authorities of Kew Gardens are anxious to obtain for the museum attached to the gardens.

The Under Secretary of State for the Department of the Interior informs me that it is quite impossible to get any of these beans, as all the machines for making them have been confiscated.

I have, &c.
(Signed) P. Le Poer Trench.

The Marquis of Salisbury, K.G.,
&c. &c. &c.

CCIX.—KANAFF OR DECCAN HEMP.

(*Hibiscus cannabinus*, L.).

Recently an announcement has been made of the discovery of a new textile plant on the shores of the Caspian. The plant known as Kanaff by the natives is said to yield a soft elastic and silky fibre, capable of being readily bleached or dyed in every shade of colour. From a report which appeared in a Tiflis journal, it is supposed that Kanaff fibre, from its abundance and consequent cheapness, and its extraordinary durability, will successfully compete with any other textile for sacking, ropes, and pack-thread. The fibre is said to have a greater resistance than hemp, and its specific gravity is less.

The chief source of information respecting the plant yielding this fibre is contained in an article entitled *Note sur le Sunn, le Yucca, et quelques autres plantes textiles*, by MM. Jules Grisard et Max. Vanden-Berghe, in the *Revue des Sciences Naturelles appliquées*, 1890, pp. 992–993. According to these authors, Kanaff or Kanap was at one time supposed to be *Apocynum sibiricum*. It is however now identified as *Hibiscus cannabinus*, L., a well-known fibre plant in India, also found in a cultivated state in Persia, and other places westward. In a note in Boissier's *Flora Orientalis*, vol. i., p. 840, it is stated that *Hibiscus cannabinus*, L., is cultivated in the province of Ghilan in Persia, and that cords and ropes are prepared from its fibre. Specimens of Kanaff fibre have recently been received at Kew, but no authentic specimens of the plant producing it have so far been seen. There is every probability, however, that the plant is one of the many varieties of *Hibiscus cannabinus*, and the utilisation of its fibre on the shores of the Caspian is a fact of some interest. The information so far furnished is as follows:—

"The French *Revue des Colonies* reports the discovery of a new textile on the shores of the Caspian. This plant, called Kanaff by the natives, grows in the summer, and attains a height of 10 feet, with a diameter varying from two to three centimetres. By careful cultivation and manipulation, M. O. Blakenbourg, a chemist and engineer, who has made a special study of Kanaff, has obtained an admirable textile matter; it is soft, elastic, and silky, gives a thread, which is very tough, and can be chemically bleached without losing its value. The stuffs manufactured out of Kanaff, and then bleached, can be successfully dyed in every shade of colour, and would compete with any of the furnishing materials now in use. But it is particularly for making sacks, tarpaulin, ropes, &c., that this new textile, from its cheapness and its extraordinary resisting power, might defy all competition. Its specific weight is much less, but its resistance much greater than those of hemp. Thus, a cord of 8·25 mm. diameter, woven with the hand out of three threads of Kanaff, requires a weight of 180 kilogrammes to break it. A cord half an inch thick, manufactured at Moscow, did not break till the weight of 625 kilogrammes was reached. When it is considered that Russia annually consumes more than 150,000,000 of sacks, a third of which is imported, it may easily be seen that the appearance of this new textile on the Russian market is an event of no slight importance." (*Board of Trade Journal.*)

The following more recent information respecting Kanaff has been communicated to this establishment by the Foreign Office :—

(Copy.)

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, July 6, 1891.

I AM directed by the Secretary of State for Foreign Affairs to transmit to you, to be laid before the Director of the Royal Gardens the accompanying despatch, reporting on the cultivation of cotton in the Caspian district, and transmitting some fibre of a newly discovered plant.

I am, &c.
(Signed) JAMES FERGUSSON.

The Assistant Director,
Royal Gardens, Kew.

(Extract.)

Mr. Vice-Consul MURRAY to FOREIGN OFFICE.

MY LORD, Batoum, June 24, 1891.

* * * * *

A newly discovered plant has been exciting great interest amongst Russian traders, as it is hoped that it will prove a strong rival to the Jute plant.

It is known as the Kanaff (Kanabe or Kanaspe) and is a textile plant found in large quantities on the Persian shores of the Caspian sea, all the production and sale being in the hands of Persians who do not know what value to put on it and therefore ask absurd prices, sometimes too high and sometimes too low.

The quality of the flax, it appears, is excellent and it is only fair to suppose that this will develope into a large industry when the prices settle.

At the present time the price is about the same as that of Indian jute, which, when the high cost of local transport is added, practically puts it out of the market.

The present price is from 1¾*d.* to 2*d.* per pound.

I have the honour to enclose a sample of the fibre of this plant.

I have, &c.
(Signed) ALEX. MURRAY,
Lieutenant and Acting Consul.

The Right Hon.
The Marquis of Salisbury, K.G.,
&c. &c. &c.

A full account of Deccan or Ambasi hemp obtained in India from *Hibiscus cannabinus* is given in the *Dictionary of the Economic*

Products of India, vol. iv., pp. 231–236. The plant is a herbaceous shrub apparently wild in some parts east of the Northern Ghâts but largely cultivated for its fibre throughout India. The produce is chiefly used by the agricultural classes locally. Dr. Watt, C.I.E., states that the fibre is soft, white, and silky and eminently suitable for the coarser textile purposes to which jute is applied. Were a demand to be created for this fibre as distinct from that of Sunn-hemp or other fibres the cultivation of the plant might be indefinitely extended, and with profit to many needy cultivators who are unable to produce either jute or cotton. The leaves of *Hibiscus cannabinus* are used as a pot herb while the seeds are sometimes exported from India to England as an oil-seed.

CCX.—INDIGENOUS PLANTS OF YORUBA-LAND.

Mr. Alvan Millson, Assistant Colonial Secretary of Lagos, West Africa, and lately a special commissioner to the interior of the native territory of Yoruba-land has prepared several interesting reports on the results of his mission. An account of the soil and of the native agricultural industries of Yoruba was printed in the *Kew Bulletin* for October 1890, p. 238, and a list of Yoruba timbers with notes respecting the most interesting, was given in the *Kew Bulletin* for February 1891, p. 41. The botanical collections made by Mr. Millson in the Yoruba country, were transmitted to Kew and carefully examined. Although the collections did not contain any striking novelties, there appear to be several undescribed species, and better material than Kew previously possessed, of a number of interesting plants. Specially valuable are seed-vessels of 100 (*Bombax*) and of 85 (*Triaspis*); *Vitis mossambicensis* (53) is new from Western Africa; 4 is probably a new species of the curious genus *Brachystegia*; 20 (*Macrosphyra*), and 97 (*Psilanthus*) were slenderly represented in the Kew Herbarium; 103 (*Diospyros*) is probably undescribed, though there are specimens of the same species collected by Burton and H. H. Johnston; 72 (*Phygelius?*) is an interesting plant from this region; 139, of which flowers are desired, is perhaps a new genus of Euphorbiaceæ and near *Microdesmis* (15); 42 and 135 are ♀ and ♂ respectively of the little known *Lepidoturus laxiflorus*, of which the fruit was till now unknown; 106 is an Urticaceous plant which cannot be more nearly determined without better specimens; finally, 89 is an undescribed genus of petaloid monocotyledons, imperfect specimens of which were collected by G. Mann, ripe fruit (seed-vessels) of this is much wanted.

Colonial Office to Royal Gardens, Kew.

Sir, Downing Street, 13 August 1890.

I am directed by Lord Knutsford to transmit to you a copy of a despatch from the Governor of Lagos with its enclosures, including a schedule, which is sent in original, of a botanical collection which has been made by Mr. Alvan Millson during his late expedition into the interior. The Crown Agents will be requested to send the specimens to you, if they have not already done so.

I am, &c.
(Signed) R. H. Meade.

The Director,
Royal Gardens, Kew.

Sir Alfred Moloney to Colonial Office.

My Lord, Government House, Lagos, 25th June 1890.

I have the honour to transmit for your Lordship's information a vocabulary of an interesting botanical collection comprising 149 herbarium specimens made by Mr. Alvan Millson on the occasion of his recent visit to the interior of Yoruba. The habitat may be viewed as situate between 6° 40′ and 8° north latitude and 3° 40′–5° east longitude.

2. Your Lordship will, I am sure, appreciate this further proof of Mr. Millson's zeal, and observe with satisfaction that his collection contains specimens of several economic plants yielding gums, fibres, and dyes in extensive daily use by the people, and doubtless capable in time of considerable commercial development.

3. The Yoruba country offers, as has been repeatedly pointed out, a field ready for enterprise and rich in the products named, but it requires more freedom of inter-communication and the intelligent activity, interest, and support of the commercial community brought to bear on its development.

4. The Government have always been alive to the importance of advertising the capabilities of the country with small encouragements so far as regards practical result. For instance, attention has been often called to the large quantity of Ogea gum (*Daniellia*, sp.) in the country. At last, even at the low local value of 2½*d.* per lb., it would seem to be established as a growing article of export which began with 1885; the output of the Colony has been since as follows:—

1886 - -	1,480 lbs.
1887 - -	1,841 „
1888 - -	48,905 „
1889 - -	110,766 „

5. The specimen of the Yoruba edible fig which is described as of "fair flavour" is most interesting; its cultivation in the botanic centre has already engaged the attention of the Government.

6. The botanical collection now forwarded may be of local rather than of new scientific interest.

7. May I ask your Lordship to be good enough to invite the Director of the Royal Gardens to have the collection named and to accept it from this Government for the Kew Herbarium.

8. The column has been left in the vocabulary transmitted which I would beg to be returned for the insertion of the scientific name in each case.

I have, &c.

(Signed) Alfred Moloney,

Governor.

The Right Hon. Lord Knutsford, G.C.M.G.,

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
1	Adabi		Ikirun, W. Africa	Shrub		Clerodendron splendens, Don.
2	Lagba Omode	"Whip-child," so called from whip-like strings of corolla.	„ „	„ (flower and fruit)		Strophanthus sarmentosus, DC. and Wrightia parviflora, Bth. (mixed).
3			Esa Egure, Ijesha, W. Africa.	„ (white flower)		Ixoreæ?
4	Akko Lodo	"Met with by the river."	Ikirun, W. Africa	Tree, by rivers in their upper courses. Young leaves brilliant red. Gum exudes from wounds on bark. Fruit not found.	Use of the gum of this Acacia apparently not known to the natives.	Brachystegia n. sp.?
5			Oshogbo „	Plant		Cleome spinosa, L.?
6	Errusheshon		Ikirun „	Bush		Alafia sp.?
7	Kan-kan		„ „	Shrub		Randia macrantha, DC.
8	Ji-wi-ni		„ „	Bush		Phyllanthus (Anisonema) floribunda, Baill.
9	Agbari Ettu	"Guinea-fowl's head"	Oshogbo „	Creeper	Used as rope for tying rafters, &c. in house building. Used also medicinally, for what disease not ascertained.	Alafia sp.?
10	Buje (No. 1)		Ikirun „	Shrub (large trumpet-shaped white flowers, *see* No. 18).	Fruit used, &c. for blue tattooing on faces by all interior tribes of this part of West Africa.	Randia, near R. maculata.
11	Shawe-re-kpekpe		„ „	Plant		Cyathula geminata, Moq.
12	Je-in-joko or Jo-ko-je.	"Let me sit quiet"	Ikirun, and Iwo, W. Africa.	Creeper, white clusters with bright red seeds, very handsome.	Suppression of menses, &c.	Cissampelos Pareira, L. var. owariensis.

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
13			Ikirun, and Oshogbo, W. Africa.	Tree		Deinbollia pinnata, Schum. et Thonn?
14	Awkpawtaw		Ikirun, W. Africa	„	Native edible fig, fair flavour	Ficus guineensis, Sch. Th.?
15	Ārin-igo	"Walking on bottles"	„ „	Bush		Microdesmis puberula, Hk. fil.
16			Oshogbo „	„		Motandra guineensis, A. DC.
17	Akawn-Ekkun	"Tongue (of) leopard"	Ikirun „	Plant	Medicine for women and children, effect not ascertained.	Acanthus montanus, T. And., var.?
18	Buje (No. 2)		Ikirun and Oshogbo, W. Africa.	Shrub	See No. 10	Randia maculata, DC.
19			Oke-Ibodi, W. Africa	Plant		Dracæna phrynoides, Hook.
20	Ikuku-Ekkun	"Leopard's monkey bread" (Monkey bread = Baobab).	Ikirun „	Shrub, white flowers, heavily and sweetly scented.		Macrosphyra longistyla, Hk. f.
21				Lily		Crinum giganteum, Andr.
22	Oburo			Plant	Medicine for throat; given to patients when suffering from throat in measles or small-pox.	Amomum sp.?
23			Ijebu, W. Africa	Terrestrial orchid. Faint musky perfume; purple flowers, very handsome.		Lissochilus arenarius, Lindl.
24			Ikirun „	Terrestrial orchid. Purple flowers; no scent.		Lissochilus nr. L. purpuratus, Ldl.
25			„ „	Creeper		Asparagus, cf. A. falcatus.
26			„ „	Bush, white flowers; no scent.		Pavetta Baconia, Hiern. Vernonia amygdalina, Del.

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
27	Oshun-Shun		Ikirun, W. Africa	Tree, very hard wood	Decoction of bark used for rheumatism externally and internally. Fruit edible. Wood used for house-posts and walking sticks, resists ravages of termites.	Carpolobia lutea, Don.
28	Fe-ru		,, ,,	Shrub	Yellow dye from root; bark used for rope (Hausa-Kawaye).	Cochlospermum tinctorium, Rich.
29			,, ,,	Reed, in swamps	Tobacco-pipe stems made from hollow reed.	Olyra latifolia, L.
30			,, ,,	Bush		Combretum racemosum, Beauv.
31	Aso-fun-eye-je, or Akkaw-Ishin.	"Seeds for birds to eat," or "Male Ishin-tree." (Ishin is an edible seed similar to this.)	,, ,,	Tree		Ratonia, nr. R. zambesiaca.
32	Kaka-n'she-n'la	"Big kaka-n'she"	,, ,,	Creeper	Medicinal use not ascertained	Paullinia pinnata, L.
33			Ibadan ,,	Grass		Pennisetum Benthamii, Steud.
34			Ikirun ,,	Shrub, red flower, very handsome.	Tonic and febrifuge—decoction of leaves.	Cacoucia paniculata, Laws.
35	Agba-odo	"Sweep the water"	Oshogbo ,,	Small blue flower, bean-like fruit with velvety, silvery coating.	Used for killing fish—macerated in water and thrown into the river.	Tephrosia Vogelii, Hk. fil.
36			Ikirun ,,	Shrub		Millettia sp.
37	Ogiya (Ogea)		,, ,,	Tree	Gum used as powder for skin; scented.	Daniellia sp.?
38			,, ,,	Plant		Wissadula rostrata, Pl. Acalypha sp.
39			,, ,,	,,		Buchnera sp.

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
39 bis.						Cardiospermum barbicaule, Baker.
40			Ikirun, W. Africa	Plant		Justicia insularis, T. And. ?
41			" "	"		Ritchiea fragrans, R. Br.
42			" "	Shrub		Lepidoturus laxiflorus, Bth. ♀
43			Oshogbo "	Yellow Convolvulus		Ipomœa acanthocarpum, Chy. ?
44			Oyo "	Creeper		Amaralia bignoniæflora, Welw. ?
45	Eruwaw	"Bitter as far as the navel."	Ikirun "	Tree	"Brimstone wood." Used for canoes, planks, posts, &c. Resists ravages of termites. Used medicinally in cases of colic, fever, worms, and childbirth.	Morinda citrifolia. L.
46			" "	Creeper		Ipomœa sp.
47			" "	Shrub, white flowers		Apocynaceæ ?
48			" "	Shrub		? Rutidea sp.
49	Ibishere		" "	Tree	Leaves used when young for soup ("Egba kpa ommaw nidi obbe ibishere," proverb meaning "The Egba kills his child on account of Ibishere soup").	Myrianthus arboreus, P. de B.
50			Ijebu Ode "	"	Gum used as cosmetic and as incense for driving away evil spirits. (Timaneh language, "bongbo.")	? Albizzia.
51			Esa Egure "	"		Albizzia fastigiata, Oliv.
52				Miscellaneous		Gossypium barbadense, L. Sorghum vulgare, Pers. Coffea sp. ? Acanthus montanus, T. And. ?

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
53	Efuru		Oshogbo, W. Africa	Native grape	Fruit small, black, acid and astringent.	Vitis mossambicensis, Kl. ?
54	Kere Odan	"Wild 'Kere'"	Iwo-Oyo "	Plant		Chrysanthellum procumbens, Pers.
55	Edaw		Oshogbo "	"		Sphenoclea zeylanica, Gærtn.
56	Ewuro	"Bitter"	Ikirun "	"	Febrifuge and tonic, anthelmintic; also used as condiment.	—
57	Arojoku		Oshogbo "	"		Eclipta alba, Hassk.
58	Oboboroboro	"Very smooth"	Ikirun "	"		Alsodeia dentata, P. de B.
59	Ashawyun		" "	"		Paulowilhelmia speciosa, Hockst.
60			Oshogbo "	Water plant		—
61	Agbo ommode	"Child's decoction"	Ikirun "	Shrub	Medicine for children, laxative	Tabernæmontana Barteri, Hk, fil.
62	Akkaw-ishe-kpe-agbwe.	"Male Ishe-kpe-agbwe."	" "	"	" " "	" " "
63	Ishe-dun	"Work is sweet"	Oshogbo "	Creeper		Clerodendron sp.
64	Ake-iri		" "	Plant	Bark used to make ropes	Urena lobata, L.
65	Toto-odo	"Water odo." The "odo" leaf is used for wrapping up food	Ilesha "	"		Hæmanthus abyssinicus, Herb. ?
66	Ari-chin-k'osun	"I appear brighter than those who rub themselves with cam-wood."	" "	"		Hæmanthus multiflorus, Martyn ?
67	Odo-ommode		" "	Creeper; red elongated sweet berries.		Mussænda elegans, Sch. and T.
68	Buje Arigbo	"Old Woman's Buje" (*see* Nos. 10 and 18).	Ikirun "	Creeper		Canthium hispidum, Hiern. ?

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
69	Oshekpotufunfun	"That which gives out froth like soap when bruised."	Esa Egure, W. Africa	Plant	Used as soap, and for gonorrhea, internal and external application.	Sida carpinifolia, L.
70			Ikirun "	" blue flowers		Brillantaisia owariensis, P. de B.
71	Lobiri		Oshogbo "	"		Asystasia gangetica, T. And. (A. coromandeliana, Nees.)
72	Ittaw Awkpere		Oyo "	"		Phygelius sp.?
73	Kere	"Rattling." (The seeds rattle when shaken.)	Oshogbo "	Shrub	Decoction of leaves and seeds used for febrifuge. Decoction of seeds and roots for inflamed throat.	Cassia occidentalis, L.
74	Iyawa		Ilesha "	Plant		Mikania scandens, Willd.
75	Ododo oko	"Red flower of the field."	Ikirun "	Climber		Ipomœa involucrata, Beauv.
76	Ejirin Awdawu	"Prairie 'Ejirin'"	Oyo "			Ipomœa (Pharbitis), Nil.
77	Da ogun duro	"That which makes war stop" (barricade).	" "	Plant	Medicinal use not ascertained	Tribulus terrestris, L.
78	Akkau Ejirin or Koropo.	"Male Ejirin"	Oshogbo "	Creeper	Laxative for children	Momordica cissoides, Pl.
79	Etikpon' la	"Lick lips"	" "	"	Made into soup; used to assist menses.	Boerhaavia cf. B. diffusa.
80	Ajitana	"I awake to give light."	Ikirun "	Plant		Celosia laxa, Schum. and Thon.
81	Ogbwe Akukaw	"Cock's comb"	Oshogbo "	"		Heliotropium indicum, L.
82	Yun-yun		Ikirun "	"		Aspilia latifolia, O. and H.

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
83	Ewuro odo	"Water bitter leaf"	Ikirun, W. Africa	Plant	Used as herb in soup	Sparganophorus Vaillantii, Gærtn.
84	Agbari Ettu	"Guinea fowl's head"	„ „	Shrub		Gomphia reticulata, Beauv.
85	Abebbe awdawu	"Praire Fan"	„ „	„		Triaspis nr. T. stipulata.
86	Ayorun	"I shew my head"	„ „	Terrestrial orchid, yellow		Lissochilus sp.
87	Akawn Ekkun	"Leopard's tongue"	Oshogbo „	Plant	Much used medicinally, but use not ascertained.	Argemone mexicana, L.
88			Esa Egure „	Shrub, white flowers	Laxative for children, decoction	Tabernæmontana nr. T. Barteri.
89			Ibadan, Ijebu road, W. Africa.	Bulb-like crocus; bright blue flowers.		—
90	Iran-aji-igbo		Oyo, W. Africa	Creeper		Gymnema sp. ?
91	Aba-erode-Ife	"I go with all strangers to the land of Ife." (Ife is supposed to be the cradle of the human race.)	Oshogbo „	Plant		Desmodium gangeticum, DC.
92	Oforo		Oyo „			Hewittia bicolor, W. and A.
93	Awsawn-igbo	"Wild lime"	Ikirun „	Bush		Rutidea sp. ?
94	Ashara		Oshogbo, Oke-Ibodi, W. Africa.	Plant		—
95	Godawgbaw-odo	"Watery river plant"	Ikirun, W. Africa	Plant; in swamps	Decoction used as laxative for children.	Aneilema beninense, Kunth.
96	Ikan-yanrin	"Small Ikan"	Oshogbo „	Plant	Fruit edible	Solanum sp.
97	Ya-ya		„ „	„		Marsdenia sp. ?
98	Jaw-yan		„ „	Creeper, white flowers		Dæmia angolensis, Dcne.

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
99	Aw-waw	"Hand"	Oke-Ibodi, W. Africa	Shrub	Medicinal use not ascertained	Lankesteria elegans, T. Aud. (L. Barteri, Hook.)
100	Escho or Pompola		Oru "	Tree; brilliant red flowers	Called Pompola, when the natives speak of it as growing in the forest. Called Esho, when spoken of as a medicine, the belief being that the efficacy of the medicine would be destroyed were they to call it by its right name. Decoction of bark used to assist menstruation; powder made from the thorns mixed with oil used for "Craw-craw."	Bombax-buonopozense, Beauv.
101	Efo		Ikirun "	Shrub		Wrightia parviflora, Bth.
102			" "	Plant		—
103	Olododo	"Crimson"	" "	Shrub, dark crimson flowers, very handsome.		Diospyros sp.
104	Iya-wa		" "	Bush		? Clerodendron sp. or Premna.
105	Akpe-ji		" "	Plant		Dissotis irvingiana, Hk.
106	Ekkorraw		" "	"		Urticaceæ.
107	Ika-igbo	"Fingers of the forest bush."	Ilesha "	Creeper		Cucurbitaceæ.
108	Akara Aje	"Witch Akara." Akara = beans cooked in palm oil.	Oshogbo "	Bush		? Tabernæmontana sp.
109	Akkaw-yun-yun	Male yun-yun	Ikirun "	Plant	Decoction for "craw-craw" externally. Decoction for fever internally.	Ageratum conyzoides, L.

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
110	Ikan-igbo		Ikirun, W. Africa	Creeper	Medicinal use not ascertained	Sabicea calycina, Bth.
111	Ofo-odon	"The 'empty' or sterile plant of the prairie."	Esa Egure „	Plant		Hibiscus vitifolius, L.
112	Agbon-igbo		Ikirun „	Creeper		Combretum mucronatum, S.andT.
113	Dagba		„ „	„		Clerodendron volubile, P. de B.
114	Godawgbaw-odo	"Plant that grows in water."	„ „	Plant, in swamps		Commelina nudiflora, L. var. werneana, Hassk.
115	Adodo		„ „	Bush		Tabernæmontana sp.
116	Gboyin Gboyin, or Buje werre.	"Small Buje"	„ „	Shrub	Used for blue tattooing. (*See* Nos. 10 and 18.)	Tapiria?
117	Apo-iba	"Puzzle fever"	„ „	Plant	Febrifuge, also used for cough and sore eyes.	Dissotis plumosa, Bth.
118	Koro		„ „	Creeper		Ipomœa sessiliflora?
119	Aboro		„ „	Plant		Achyranthes argentea, Lam.
120	Akkaw-Ajaw-yun	"Male Ajaw-yun"	„ „	Creeper, light blue flowers		Phaseolus? perhaps P. lunatus.
121	Shauga		Esa Egure „			Oncoba spinosa, Forsk.
122	Ekuya		Oshogbo „	Plant	Leaves used in soup. Remedy for earache, leaves tied in another leaf and roasted, juice mixed with kernel oil, and squeezed into the ear.	Gynandropsis pentaphylla, DC.
123	Dan-gbawn-gbawn		Ikirun „	Bush		Pavetta Baconia, Hiern.
124	Oggau		„ „	Creeper		Combretum racemosum, Beauv.?
125				Plant		Urticaceæ.

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
126	Otili		Ikirun, W. Africa	Plant	Native pea. Leaves used for sore throat.	Cajanus indicus, Spr.
127	Akpa-ogbwe, or Atakpara.	"I heal wounds" "I fire with a sound like 'Akpara.'"	" "		Powder used for staunching wounds under first name, and as a laxative in decoction. When the seeds are dried and put in water they explode with a popping sound.	Phaylopsis sp.
128	Akana-magbo		" "	Plant		Smilax sp.
129	Karo, or Odun-dun odo.	"Water odun-dun"	Esa Egure "	"		Emilia sagittata, DC.
130	Ekoro		Ikirun "	Bush, very handsome, clusters of red fruit and white flowers out at same time.	Decoction of leaves used as a laxative.	Cnestis ferruginea, DC.
131	Ashere, or Re-re		" "	Plant		Ammannia senegalensis, Lam.
132	Alake oko	"Prince of the field"	" "	"		Justicia (Rungia Wakefieldi, S. Moore?).
135	Ijan			Shrub	Leaves used to preserve Kola nuts	Lepidoturus laxiflorus, Bth. ♂
136	Toto		Oshogbo, W. Africa	"		Hugonia Planchoni, Hk. fil.
137	Itakun okkerre	"The squirrel's climbing place."	" "	"		Grewia carpinifolia, Juss.
138	Atorin		Ilesha "	"	Remedy for gonorrhea internally, also as tonic.	Glyphea grewioides, Hk. fil.
139	Lasaje		Oshogbo "	Bush		Euphorbiaceæ? nr. Microdesmis.
140	Ashasha		" "	"		Alsodeia subintegrifolia, P. de B.?

No.	Yoruba Name.	Meaning of Yoruba Name.	Place found.	Description.	Medicinal or other Uses.	Scientific Name.
141	Okpwe Igo	"The Igo palm"	Oshogbo, W. Africa	Plant	Decoction of seed for dysentery, and for gonorrhea.	Cyrtosperma sp.
142	"	"	" "	"		Cyrtosperma sp.?
143	"	"	" "	"		Cyrtosperma sp.
144	Okka kpukpaw	"Red guinea corn"	Ikirun "	"	Red dye	Sorghum vulgare, var.
145			Ibadan "	" handsome red flower just appearing above ground.	Decoction used for sore throat, laryngitis.	Thonningia sanguinea, Vahl.
146			Ikirun "	Plant		Phyllanthus capillaris, M. Arg.?
147	Own Sonyun	"Silk-cotton"	" "	"	Native brown cotton, coloured like the native silk or sonyun.	—
148			" "	Gum of tree, of which specimens were not obtained.	—	—
149	Akoko			Rope. Herbarium specimens not obtained.	Bark used medicinally for colic, mixed with Melaguetta pepper. Young leaves used for same purpose when macerated in cold water, strained, and the liquor mixed with corn starch. Stem of the tree used for posts and beams for building purposes. Rope made from inner bark, largely used by Houssas and Yorubas for horse ropes, &c. Tree found plentifully throughout the Ijesha forests, and cultivated in the groves of the god Oyun, the Yoruba Mars.	—

Gums.

I consider the three varieties of Ojiya (Ojea) met with to be worth further investigation, not cultivated, forest trees.

4. Akkaw L'odo. (*Brachystegia* n. sp.?) Apparently a valuable gum of the Acacia family, similar to gum arabic. One of the many Acacia gums of West Africa. Supply of the trees practically unlimited, percentage of yield per tree not ascertained. Could only be gathered during the dry season.

Fibres.

9. Agbari Ettu. (*Alafia* sp.?) Very considerably used, not cultivated, plentiful; might, if of value, become an object of export, but its value for any but native use appears doubtful.

28. Fe-ru, or Rawaye. (*Cochlospermum tinctorium.*) Bark makes good rope, largely used as such by Yorubas and Houssas; plentiful, sufficient supply for exportation, not cultivated.

64. Ake-iri. (*Urena lobata.*) Fair rope bark, used for various purposes by Yorubas and Houssas, chiefly in house building; plentiful, not cultivated.

Fruit.

14. Edible Fig. (*Ficus guineensis.*) Used as article of food in raw state, flavour agreeable and almost equal to ordinary fig, yellow when ripe; very plentiful, not cultivated.

I have not tried drying the fruit, but consider the experiment worth trying.

Dyes.

28. Fe-ru, or Rawaye. (*Cochlospermum tinctorium.*) Good yellow dye, largely used by Houssas in conjunction with Elu (indigo) for making the sacred green dye which is a secret trade of certain Houssa families. Not cultivated, very plentiful all over Yoruba-land, not used by Yorubas.

144. Red guinea corn. (*Sorghum vulgare.*) Grain edible but not used. Cultivated as a dye plant, excellent red dye; plentiful, could be exported, but doubt if it would compete with other red dyes; an experiment would be advisable.

10, 18, 116. Buje. (*Randia* spp.) Three varieties; plentiful, not cultivated. Fruit only used as colouring for tattooing, apparently not available as an article of export.

CCXI.—PLANTING IN PERAK.

(No. 171.—Circular.)

Notice to Planters, &c.—The Government of Perak, being desirous of encouraging agriculture in the State, draws attention to the existence of large areas of virgin land available for both hill and low country cultivation, and to the following, among other, advantages which this State holds out to intending planters :—

(*a.*) Proximity to Singapore and Penang—two days' steam from the former and six hours from the latter.

(*b.*) The country is traversed by good metalled cart-roads.

(*c.*) Taiping, the capital, is connected with its port, at Port Weld, by a short railway. A railway connecting the Port of Teluk Anson with the inland districts of Batang Padang and Kinta is under construction.

(*d.*) Arrangements have been in force for seven years with the Government of India, admitting of the introduction of indentured Indian labour.

(*e.*) Arabian coffee has given satisfactory results on an estate of about 1,000 acres, opened by Sir Graeme Elphinstone, in the Kuala Kangsa District, while Mr. Heslop Hill's Liberian coffee estate of about 300 acres in the same district is most promising.

(*f.*) Attached will be found a return showing remarkable crops of Liberian coffee on Messrs. Hill and Rathborne's estates in neighbouring States of the Malay Peninsula.*

(*g.*) Tea grown by Government as an experiment, and shipped to England, has been favourably reported on by London brokers.

(*h.*) The Government of the State is carried on under the advice of a British Resident, with a staff of European officers, and under the supervision of his Excellency the Governor of the Straits Settlements.

2. The Government is prepared to grant the following special terms to the first ten approved applicants who shall apply after this date, that is to say : Lease or leases in perpetuity for 1,000 acres in one block or in blocks of not less than 500 acres each. No premium ; quit-rent 20 cents an acre after two years' free occupation. The Government reserves the right of levying an export duty on produce, which may not exceed 2½ per cent. *ad valorem.* If selected with road frontage the depth to be three times the frontage ; *bonâ fide* commencement to open to be made within 12 months from Government approval of selection ; cost of demarcation and survey (to be made when required by Government) and registration fees to be borne by lessees. If desired by applicants, a premium of $3 an acre and no quit-rent will be accepted.

Minerals are reserved, and, with the above exceptions, the land would be subject to the general Land Regulations of the State, which will be forwarded on application to the State Commissioner of Lands, Taiping, to whom all communications in connexion with this circular should be addressed.

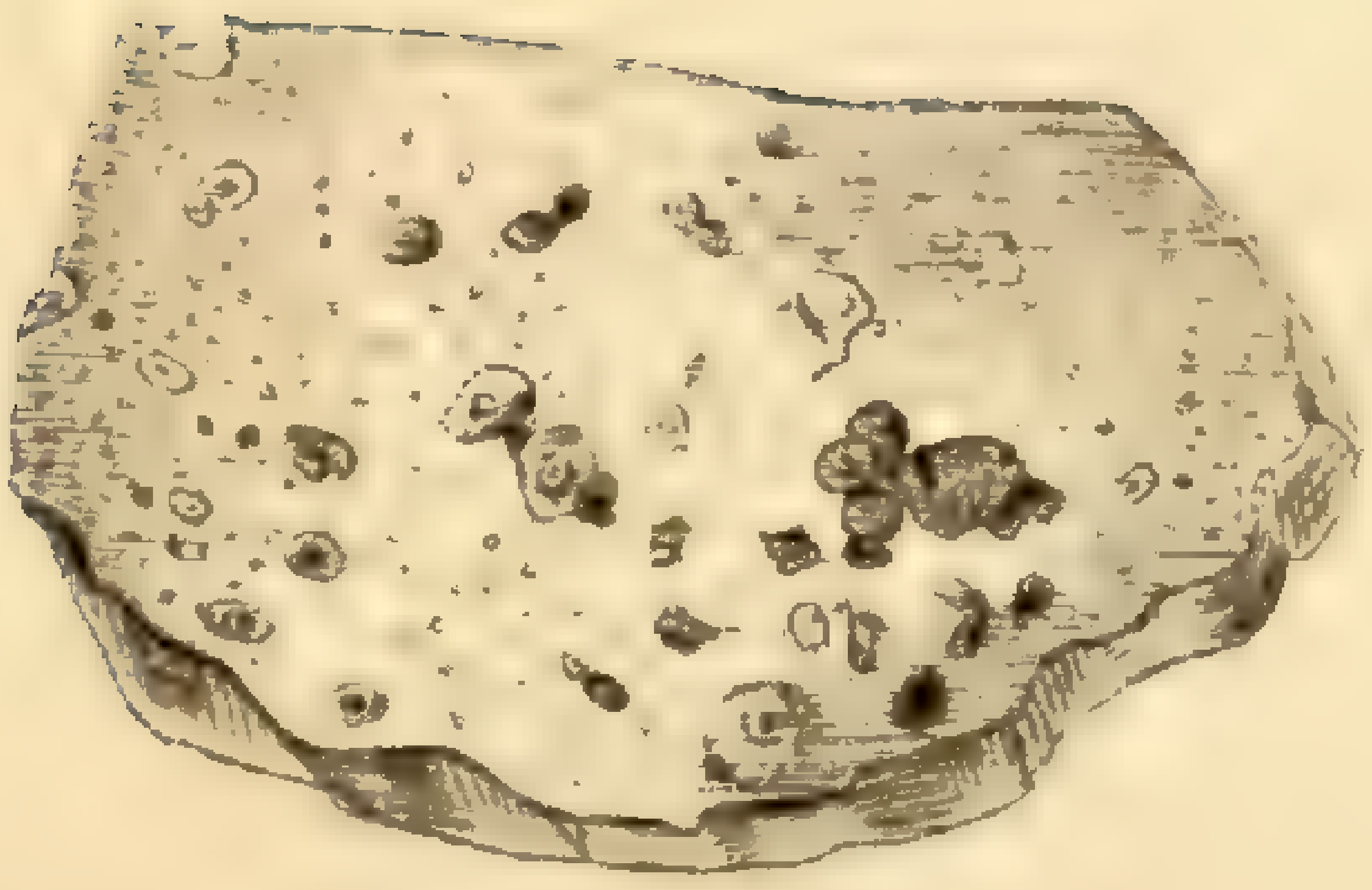
By command,
W. H. TREACHER,
Secretary to Government.

Government Secretary's Office,
Taiping, 22nd April 1891.

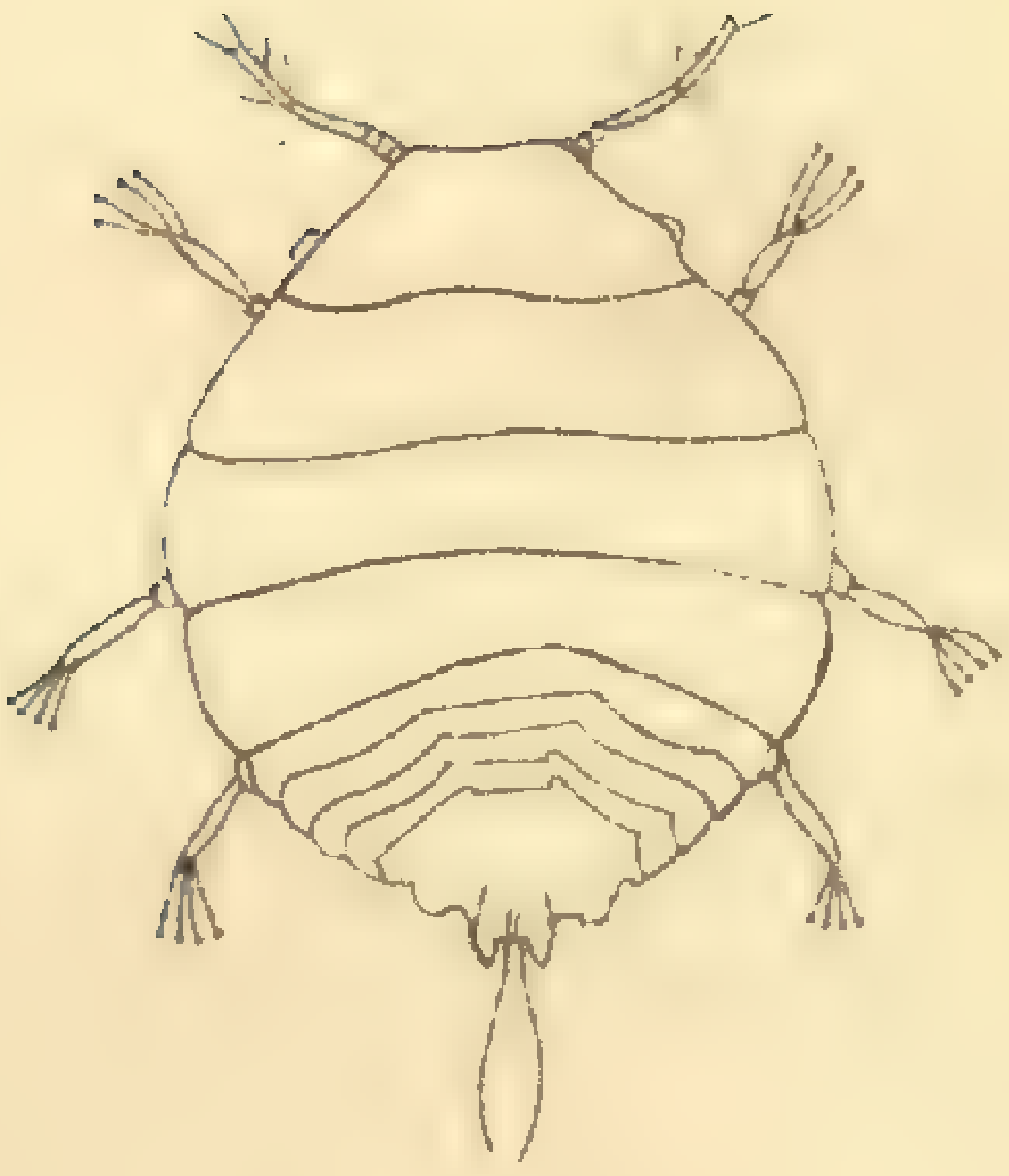
---

* This is not printed, as similar information has already been given in the *Kew Bulletin* for 1888, p. 262, and 1890, p. 107.

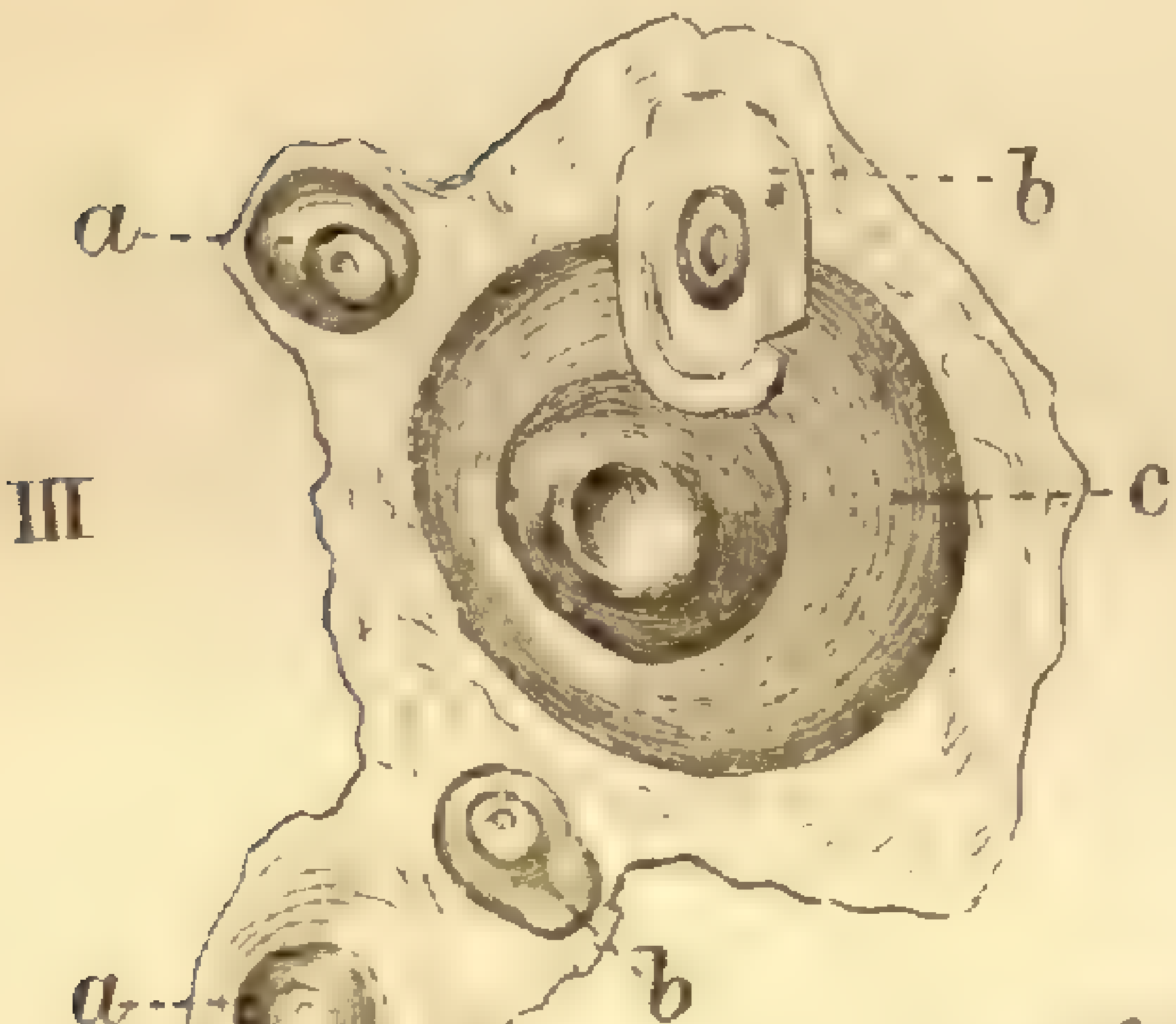
I



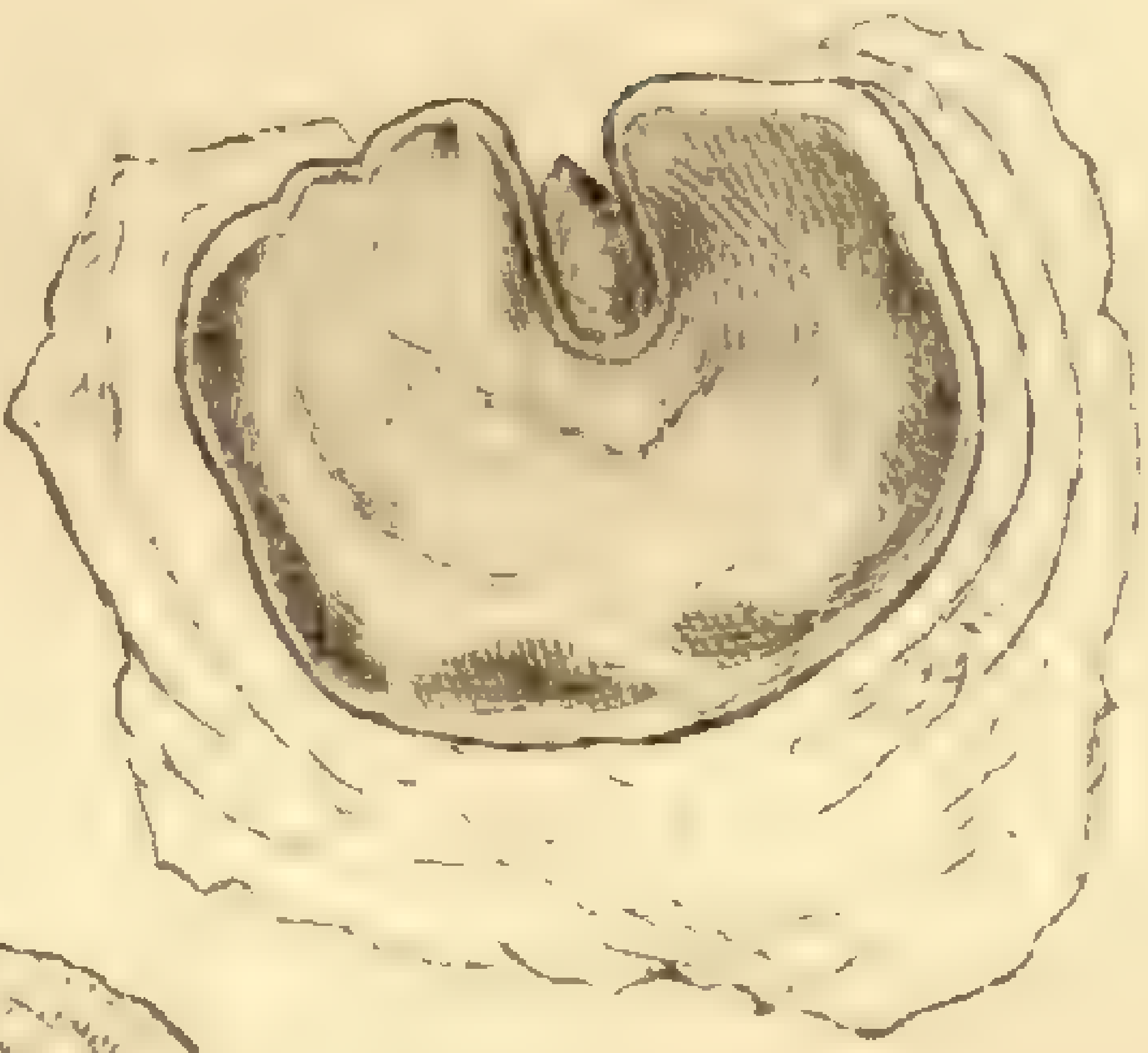
II



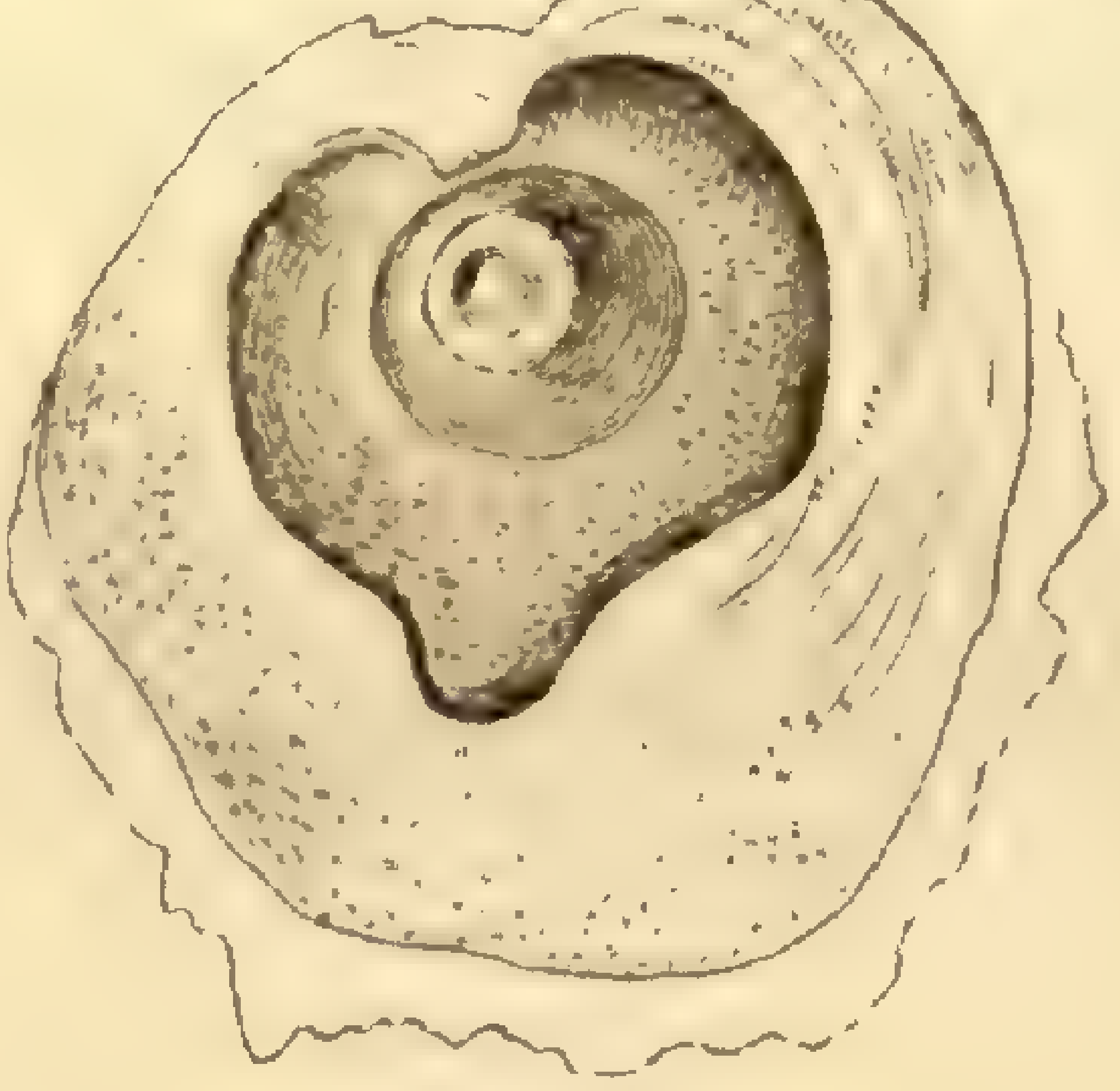
III



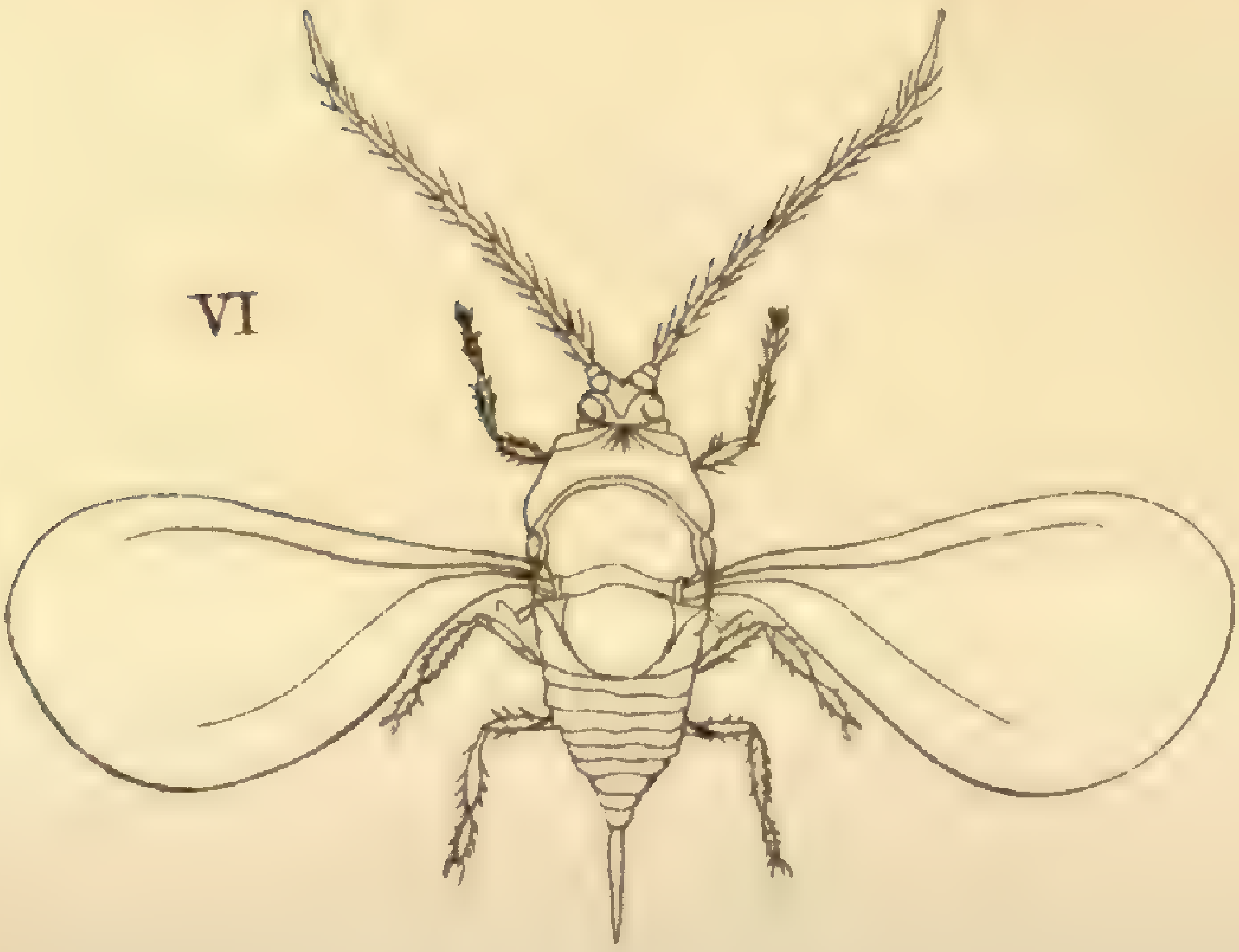
IV



V



VI



[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 57.] **SEPTEMBER.** **[1891.**

CCXII.—ORANGE SCALE IN CYPRUS.

(*Aspidiotus aurantii.*)

Orange trees in certain localities are peculiarly liable to be attacked by scale insects. The result, in many cases, is a serious loss to cultivators. Scale insects have been noticed to be more prevalent on orange trees in a dry climate than in a moist one. The particular insect now under notice (*Aspidiotus aurantii*) is widely distributed throughout tropical and sub-tropical regions, and the remedial measures which are recommended for its treatment cannot be too widely known. Mr. Arthur E. Shipley, F.L.S., who has undertaken the present inquiry, is Demonstrator of Comparative Anatomy at the University of Cambridge, and possesses special qualifications for work of this kind. It will be noticed that Mr. Shipley is desirous of receiving specimens of coccidæ which infest plants, as also of the nematode worms parasitic on plants with portions of their respective hosts.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
88 and 90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Twopence.

Mr. Arthur E. Shipley, F.L.S., to Royal Gardens, Kew.

Christ's College, Cambridge,
July 16, 1891.

Dear Mr. Thiselton-Dyer,

In forwarding you the enclosed report, I should like to take the opportunity of making it known that I am very anxious to obtain (i) examples of coccidæ which infest plants, and (ii) examples of nematode worms parasitic in plants, with the affected parts of their respective hosts.

I should be very grateful to anyone who would send me, at the above address, specimens of these two classes of plant pests.

Yours, &c.
(Signed) Arthur E. Shipley.

W. T. Thiselton-Dyer, Esq., C.M.G., F.R.S.

Report on an Orange Disease in Cyprus, caused by a Scale Insect.

The material which forms the text of the following report was kindly sent me by Captain Arthur Young, Commissioner at Famagusta, who has also been good enough to forward me the details of the spread of the pest throughout Cyprus, which will be found below.

The disease is caused by the presence of a scale insect, *Aspidiotus aurantii*, Maskell, which is a member of the sub. family *Diaspinæ*. This sub-family with some others, compose the family *Coccidæ*, insects popularly known as Scale insects, Bark lice, Mealy bugs, &c. *Aspidiotus aurantii* seems to have been first named *Aspidiotus coccineus* by the Greek entomologist Gennadius, and, since this name has priority, it ought to have been retained. Nevertheless, the American entomologists, to whom we are almost entirely indebted for our knowledge of the methods of dealing with this pest, consistently use Maskell's name, and I have therefore thought it well to do the same. The species has also been called *Aspidiotus citri*, and is popularly known in America as the Red scale of California.

The precise home of this insect has not yet been determined, and it is variously stated to be Europe and Australia. It is one of the most, if not the most, destructive of the insects which attack orange or lemon trees, and is notorious for the damage it has done in California, and, more recently in Florida, in Australia, New Zealand, and other parts of the world. A single instance of the loss this pest occasions may be quoted from Mr. Comstock's report of 1881. The rental of an orange grove of 33 acres had to be reduced from 1,800*l.* to 120*l.* in six years on account of the ravages of this insect.

The disease seems to have been noticed in Cyprus for the last six or eight years. In the district of Limassol the insect was found six years ago in every garden at Episcopi and Kolossi, two orange districts, and it must have been there for some years previously. At Nikosia it has been prevalent for eight years or more, and at Larnaca for at least six years. It was first noticed at Famagusta in 1888, but it was only in 1890 that the gardens were seriously affected. The sweet lemons are the first attacked, then the lemons, and lastly the oranges ; old and young trees are attacked alike. On the whole it seems that the disease is taking firm hold in the island, and prompt measures should be at once taken to arrest its progress before it is too late.

Appearance of the Diseased Trees.

The scale is found on the fruit, leaves, and smaller branches of the affected trees. In the specimens sent to England, both the oranges and lemons were so covered with the insect that at least half the outside of the fruit was concealed by their presence, and there must have been several thousand insects on each orange. Fig. I. attempts to represent the appearance of a piece of orange peel, only very slightly magnified, with the scales scattered over it. An enlarged view of several scales is given in Figs. III., IV., and V. The scale or puparium is really a dirty white, but the body of the insect which underlies it gives the whole a brownish-yellow or dark brown appearance. Some of these, as Fig. I. shows, are much darker than others; they very often overlap one another.

With a lens three different stages of the insect can be detected—(i.) large scales, Figs. IV. and V., which are the mature females after their second moult. The scale which covers them also protects the eggs when they are laid; (ii.) small circular scales (Fig. III*a*.), which cover the female after its first moult. These are formed from the mobile larva (Fig. II.) after it has come to rest and cast its skin. After a second moult these become the large scales, No. i.; (iii.) small oval scales (Fig. III*b*.) which cover the male insect. They are formed in the same way as No. ii.; by the casting of the larval skin. They will ultimately give rise to the winged males (Fig. VI.). A few specks may be seen creeping over the orange peel. These are the mobile larvæ (Fig. IV.) seeking for a resting place.

The Life History of the Insect.

The various stages through which these scale insects pass, in their passage from the egg to the mature form, differ somewhat in the two sexes, so that it will be advisable to consider them separately.

The Female.

We will commence with the female. The eggs which are found massed together under the scale give rise to minute larvæ, which are all but invisible to the naked eye. When magnified, each larva has the form of a slightly oval flattened insect, whose longitudinal axis is but little longer than the transverse (Fig. II.).* This larva is provided with three pair of legs and a pair of antenna, and well developed mouth appendages which collectively form the "rostrum." It now moves actively about over the orange or lemon, or the leaves of these trees, in search of a convenient place to fix itself. This it does by inserting its rostrum into the tissues of its host, and by this means it sucks up the nutritive juices of the plant.

Soon after fixing itself the larva casts its skin, and as a result of this operation, it loses both its legs and antennæ; thus the female fixes itself, and immediately after loses its locomotive organs; hence it becomes fixed for life on the spot where it first took up its position.

The larval skin is not entirely thrown off, but remains covering the insect, and forming the scale, shield, or puparium. In allied species this scale is partly composed of a considerable waxy secretion, which issues from the spinnerets in the form of a cottony, fibrous mass, but the females of *Aspidiotus aurantii* are distinguished from those of allied species by the absence of groups of spinnerets, and although some secretion probably serves to keep the cast skin in its place, this is much less abundant than in other species.

---

* This figure represents the larva of an allied form, *Aspidiotus ficus*. It is copied from Comstock.

The insect lies thus for some time, covered by its larval skin, and sucking in the plant juices by means of its long proboscis or rostrum. When it is about twice as old as it was at the period of its first casting its skin, it undergoes a second and final moult. The skin thus thrown off is added to the first, and the insect lies as a motionless mass covered in by the two larval skins, which with probably but little secretion, form the scale of the adult female (Figs. IV. and V.). The female is probably fertilized soon after the second moult, and its body soon becomes swollen with eggs. These are deposited after about the same interval has elapsed as existed between the first and second moults, or between the birth of the larva and the first moult. Thus the life of the female may be divided into three periods, approximately equal in length, and limited respectively by the first and second moult, and the deposition of the eggs. The ova are found under the scale, and the body of the female collapses and dries up, thus making room for them. After a certain interval they give rise to the six-legged larvæ described above.

The Male.

The early stages of the male, the egg, the larva, and the first moult resemble closely the similar stages of the female. The stage following the first moult resembles in outward appearance the corresponding stage in the female; the only difference is that the scale is longer and more oval (Fig. III*b*.).

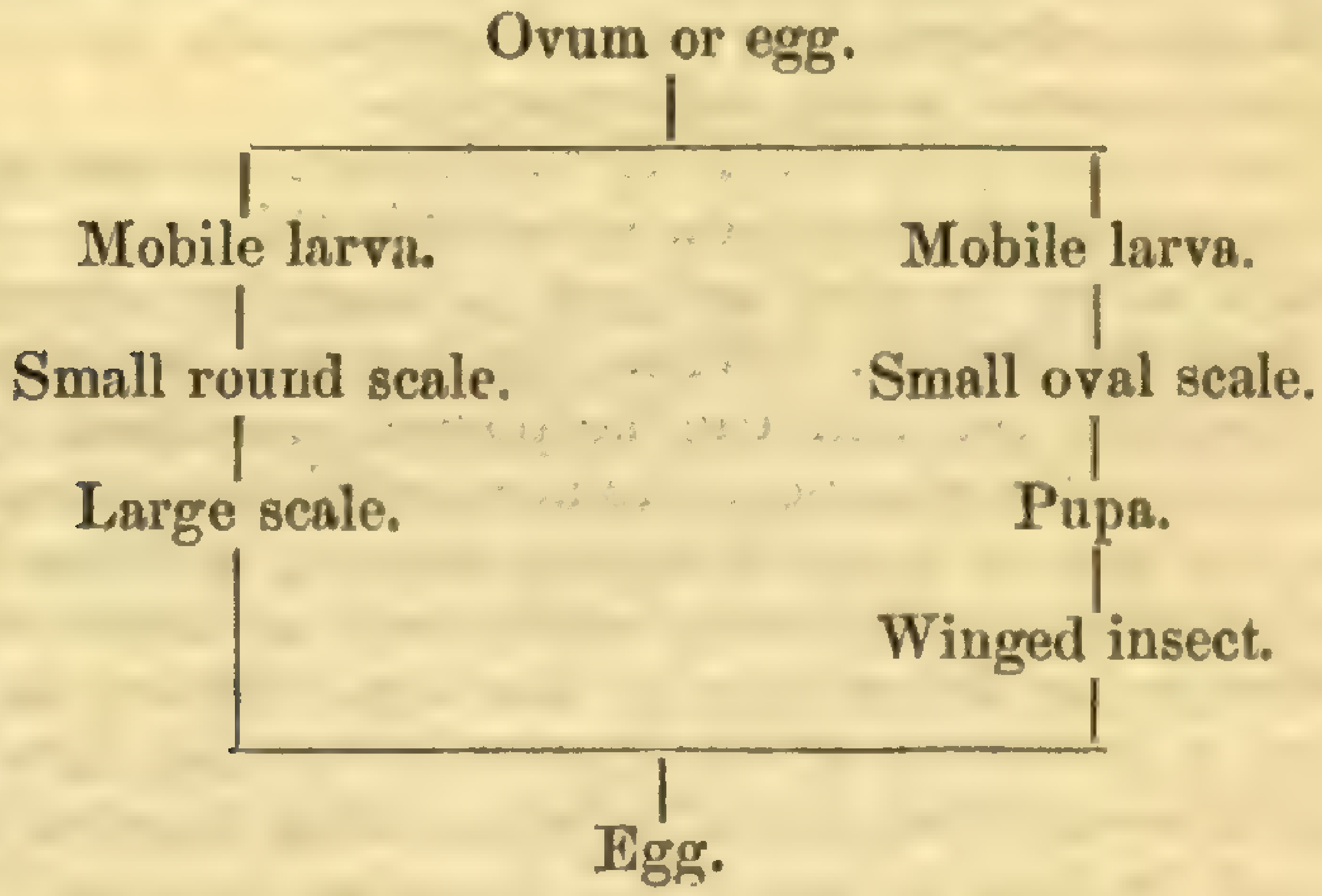
If, however, the insect be examined with a microscope, striking differences can be detected between the two sexes in this stage. Whereas the female remained motionless throughout life, the male ultimately becomes mobile, and already legs, wings, and antennæ are beginning to make their appearance. The stage between the second and third moults is termed the pupa, and the insect in this condition possesses legs and antennæ. The pupa casts its skin, and gives rise to the adult-winged male.

The perfect male (Fig. VI.) is a small insect of a brownish-yellow colour, which possesses a pair of anterior wings of large size. These, when the insect is at rest, lie flat, partly overlapping one another, and are of about the same length as the body. They enable the male to fly readily. The posterior pair of wings are replaced by halteres, which resemble the similar structures amongst the Diptera. The thorax is short and thick, and the abdomen is prolonged into a long process or style, which forms the external organ of reproduction.

During their metamorphosis the males lose their mouth parts, and their place is said to be taken by a pair of supplementary eyes. The adult males are thus incapable of taking food, and their short life is entirely devoted to fertilizing the females.

They are so minute that it is difficult to find them, and the easiest way of procuring them is to rear them from the scales on pieces of orange peel or leaf, which should be enclosed in small boxes with glass lids.

The following scheme represents the life history of this insect:—



Methods of Treatment.

We are in the main indebted to the officers of the division of entomology of the United States Department of Agriculture for the numerous methods which have been devised for dealing with this pest. The most successful of these is undoubtedly the treatment by hydrocyanic gas. The method of applying this, and the apparatus used, requires a detailed account, and I have thought it would be of service to quote the following pages from the report of Mr. D. W. Coquillett,* who has done so much to aid the orange growers of California in their efforts to combat this and other insect pests.

The Gas Treatment for the Red Scale of California.

"Briefly speaking, this process consists in covering the infested tree with an air-tight tent, and afterward charging the tent with hydrocyanic gas. The material commonly used in the construction of the tent is what is known as blue or brown drilling. A few persons have used ducking instead of the drilling, but this is much inferior to the latter; in the ducking the threads of which it is composed extend only lengthwise and crosswise, whereas in the drilling they also extend diagonally—this belonging to the class of goods to which our merchants apply the term "twilled"—and for this reason the drilling is both stronger and closer in texture than the ducking.

"After the tent is sewed up it is given a coat of black paint, as it has been ascertained that tents treated in this manner last longer than those which have been simply oiled with linseed oil. Some persons mix a small quantity of soap suds with the paint in order to render the latter more pliable when dry, and therefore less liable to crack. Instead of thus painting the tent some persons simply give it a coating made of an inferior glue called "size," first dissolving this in water and then covering the tent with it, using a whitewash brush for this purpose. Sometimes a small quantity of whiting or chalk (carbonate of lime, $Ca\ Co_3$), is added to this sizing with or without the addition of lamp-black. A few make use of the mucilaginous juice of the common Cactus (*Opuntia engelmanni*, Salm.) for this purpose; to obtain this the Cactus leaves or stems are cut or broken up into pieces, thrown into a barrel and covered with water, after which they are allowed to soak for three or four days; the liquid portion is then drawn off, and is ready for use without further preparation. Tents which I saw that had been prepared with this substance were to all appearances as air-tight and pliable as when prepared in any other manner.

---

* U. S. Department of Agriculture, Division of Entomology. Bulletin No. 23.

"A tent 26 feet tall by 60 feet in circumference—a size large enough to cover the largest orange tree now growing in this State—if made out of drilling, and either painted or sized, as described above, will cost completed about 60 dollars. Where the trees to be treated are not more than 12 feet tall the tent can be placed over them by means of poles in the hands of three persons; to accomplish this, three iron rings are sewed to the tent at equal distances around, and 6 or 7 feet from the bottom of the tent; immediately under each of these rings an iron hook is attached to the lower edge of the tent. When the latter is to be placed over a tree each of the hooks is fastened into the corresponding ring above it; one end of a pole is then inserted into each of these rings, and the tent is raised and placed on the tree. The hooks are then released from the rings and the lower edge of the tent allowed to drop upon the ground.

"Instead of allowing the tent to rest directly on the tree some growers use an umbrella-like arrangement, the handle of which is in two pieces, which are fastened together with clamps provided with pins; this allows the handle to be lengthened or shortened according to the height of the tree. This apparatus is put up over the tree, and the tent allowed to rest upon it. By the use of this simple device the danger of breaking off the small twigs on the upper part of the tree by the weight of the tent is avoided. Mr. Leslie, of Orange, used four tents and tent rests of this kind, and he informs me that with the aid of two men he fumigated 120 trees in one night. To remove the tent from one tree, place it over another, and charge the generator required only one minute and a half. In the place of poles some persons attach a circle of gas pipe to the lower edge of the tent; then two men, each taking hold of opposite sides of this circle threw the tent over the tree. Dr. J. H. Dunn, of Pomona, informs me that four men, using six tents like the above, fumigated 240 orange trees in one night, and that the average for each night was over 200 trees, the latter being 8 feet or less in height. After the tent is placed over the tree the next step is to charge it with the gas. The materials used for the production of the gas consist of commercial sulphuric acid ($K_2 SO_4$), fused potassium cyanide (KCN), and water, the proportions being one fluid ounce of the acid, one ounce by weight of the dry cyanide, and two fluid ounces of water. The generator is placed under the tent at the base of the tree; it consists of a common open earthenware vessel. The water is first placed in the generator, then the acid, and last the cyanide, after which the operator withdraws to the outside of the tent and the bottom of the latter is fastened down by having a few shovelfuls of earth thrown upon it. The tent is allowed to remain over the tree for a period of from 15 to 30 minutes, according to the size of the tree.

"It was found by experimenting that the trees were less liable to be injured by the gas when treated at night than they were when operated upon in day time, and at the same time the gas is just as fatal to the scale insects when applied at night as it would be if applied in the day time; and, indeed, it appears to be even more fatal when applied at night. This is accounted for by reason of the fact that in the day time the light and heat decompose the gas into other gases which, while being more hurtful to the trees, are not so fatal to insects. At night the trees are also more or less in a state of rest, and, therefore, are not so liable to be injured by the gas as they would be in the day time, when they are actively engaged in absorbing nourishment and replacing wasted tissue with new materials.

"Of the different materials used in generating the gas, the most important is the potassium cyanide; of this there are three grades: the mining cyanide, commercial cyanide, and the C.P. (chemically pure). Of these three brands, the mining cyanide is wholly unsuitable for the production of the gas, and the C.P. is too expensive; the commercial brand (fused) is the only one that is used for producing the gas, but even this varies greatly in strength, containing all the way from 33 to 58 per cent. of pure potassium cyanide. It is, therefore, of the utmost importance that the operator should know the exact per-centage of pure potassium cyanide that his cyanide contains, and when large quantities of it are purchased at one time it would be advisable to obtain one or more analyses of it by a reliable analytical chemist; or if it is not possible to submit the cyanide to such person, an analysis of it could be made by almost any person accustomed to the use of chemicals or drugs.

"The only substance required for this purpose is the crystals of nitrate of silver ($Ag\ NO_3$), which may be obtained at almost any well-stocked drug store. Dissolve the nitrate in cold water contained in a glass or earthen vessel, using one-fourth of an ounce (Troy) of the crystals to one pint of water; this dissolves in a few minutes, forming a whitish, semi-transparent solution. The cyanide, when dissolved in water, forms a transparent, nearly colourless solution; when a small quantity of the nitrate of silver solution is added to this it at first spreads out in a white cloud, like milk, but it soon breaks up into small, white, floccy pieces which gradually disappear upon being agitated, leaving the solution nearly as transparent as at first; when more of the nitrate of silver solution is added from time to time the above process is repeated, except toward the last, when the cyanide solution becomes somewhat milky, but it still remains semi-transparent, permitting the operator to see quite clearly the bottom of the vessel containing the solution. As soon as a sufficient quantity of the nitrate of silver solution has been added to the cyanide solution the latter immediately becomes white and opaque, like milk, completely concealing from view the bottom of the vessel containing it. This completes the operation, and the quantity of nitrate of silver solution used will indicate the strength of the cyanide tested. When absolutely pure, 5¾ grains of the potassium cyanide dissolved in water will require one fluid ounce of the above nitrate of silver solution before the turbidity occurs, indicating that the cyanide is 100 per cent. strong; if only one-half of a fluid ounce of the nitrate of silver solution produces this turbidity, this indicates that the cyanide is only half strength, or 50 per cent. strong; if only one-fourth of a fluid ounce is required, then the cyanide is 25 per cent. strong; and so forth. The nitrate of silver solution should be added to the cyanide solution very slowly, the latter being agitated by gently shaking it each time that any of the nitrate solution is added. Wherever any of the nitrate of silver solution comes into contact with the skin or nails of the hand it produces a reddish or black stain, which can easily be removed by washing the stained part in a solution of cyanide and water; this will quickly remove the stain without causing any injury to the parts affected, except, of course, when the stains occur upon a sore or cut in the hand, in which case it would be dangerous to apply the cyanide to these places.

"It sometimes happens that the per-centage of cyanogen (CN or Cy) is given, instead of the per-centage of potassium cyanide (KCN or KCy); but in cases of this kind the per-centage of cyanide can be readily ascertained by always bearing in mind that two-fifths of a given quantity of potassium cyanide is cyanogen. Thus if a certain brand of cyanide contains 24 per cent. of cyanogen, this is equivalent to 60 per cent. of pure potassium cyanide. Potassium cyanide when absolutely pure (equal to 100 per cent.) contains 40 per cent. of cyanogen; and, therefore, no grade of cyanide could contain a larger per-centage of cyanogen than this.

"The potassium cyanide used for producing the hydrocyanic acid gas is principally manufactured by two firms: Power and Weightman, of Philadelphia, Pa., and the Mallinkrodt Chemical Works, of St. Louis, Mo. That made by the first named firm is the most largely used; when purchased by the ton the price is 36 cents per pound for the grade containing about 57 per cent. of pure potassium cyanide, packages and carriage extra. It is put up in tin cans holding 10 pounds each, and also in barrels holding about 400 pounds each. That in the cans is much to be preferred, since the quantity in each is so small that it will soon be used up after the can is opened; whereas, the barrel containing so large a quantity, the cyanide used towards the last will have lost much of its strength by contact with the air. It is customary to weigh out the cyanide in small paper parcels, and mark each parcel with the number of ounces of cyanide that it contains; then when the tree is to be fumigated it is an easy matter for the operator to select one of the parcels containing a sufficient quantity of the cyanide for the tree, thus saving the trouble of weighing out the cyanide as it is to be used for each tree. As the fumigating is done only at night the weighing of the cyanide is frequently done by the ladies of the house upon the day preceding its use.

"The quantity of cyanide to be used on each tree will, of course, depend not only on the size of the tree but also on the strength of the cyanide used. The following table will aid in determining the proper quantity of each ingredient to be used on different sized citrus trees, the cyanide being about 58 per cent. pure :—

Height of Tree.	Diameter of Tree-top.	Water.	Sulphuric Acid.	Potassium Cyanide.
Feet.	Feet.	Fluid ozs.	Fluid ozs.	Ounces.
6	4	⅔	⅓	⅓
8	6	2	1	1
10	8	4½	2¼	2¼
12	10	8	4	4
12	14	16	8	8
14	10	10	5	5
14	14	19	9½	9½
16	12	16	8	8
16	16	29	14½	14½
18	14	26	13	13
20	16	36	18	18
22	18	52	26	26
24	20	66	33	33 "

This treatment is not only fatal to *Aspidiotus aurantii*, but also to any other scale insects which may be found on the orange, and to numerous other insects. The gas is of course poisonous to man and other animals, and care should be exercised in using it. At the same time it has been used in a very extensive scale in California, fully 20,000 trees were treated in Orange County alone in 1890; and Mr.

Coquillett states that he has not yet heard of any accident either to human beings or domestic animals resulting from this treatment.

The Spray Treatment.

The gas method of treatment, if properly applied, has a great advantage over any method of spraying, inasmuch as every insect in the tree is killed, whereas it is almost impossible to apply the spray so thoroughly as to leave no insects untouched, and those that escape may form the starting point of a new outbreak. Nevertheless, the gas treatment requires a special apparatus, which may not be at hand, whereas the spray, which has been used with very good effect, is comparatively easily applied. The wash which has proved most useful is the Resin Wash.

(i.) *The Resin Wash.*

The following receipt, given in Insect Life, Vol. II., has proved very efficacious:—

Resin - - -	20 pounds.
Caustic soda 70 per cent. -	6 pounds.
Fish oil - - -	3 pounds.

Water enough to make 100 gallons.

It is prepared by placing all the ingredients in a kettle and covering them with water. Boil and stir for about two hours, or until the mixture will dilute evenly with water, then add water slowly till the kettle be full. This may then be emptied into a larger receptacle and diluted with water till it amounts to 100 gallons. The water must be added slowly so as not to cool the mixture too suddenly. The resin and caustic soda should be crushed into powder, to facilitate solution. The cost of materials in America amounts to a little under one halfpenny a gallon. An orange tree, 16 feet high and 14 in circumference, was given 14 gallons, which was regarded as an excessive amount, but calculated on this basis the cost amounted to about 5½*d.* per tree.

The effect of the wash seems to be due to the suffocating action of the resin and fish oil saponified by the action of the caustic soda, and not to the direct influence of the last-named ingredient.

The wash is usually sprayed over the trees twice a year, in March and April, and again in August or September, but some growers prefer to spray twice in the autumn, with an interval of about two months. The wash does not seem to injure the fruit or leaves. Care must be taken that the scales in the under surface of the leaves do not escape the spray.

If any attempt be made to rid Cyprus of this pest, and it would be obviously an easier task in the case of an island than of any portion of the mainland, it would be necessary to appoint inspectors, whose business it would be to see that proper remedial measures were undertaken in every infected grove. An energetic cultivator who succeeds in freeing his own trees of the pest may fall a victim to the negligence of his neighbours. In cases of this kind it is necessary to take concerted action, as one diseased tree may become the centre from which a whole district may be infected, and to take action of this kind would necessitate some organised system of inspection.

Explanation of Plate.

Fig. I.—A portion of peel from a diseased orange, showing the scales, very slightly magnified.

Fig. II.—Larva of *Aspidiotus ficus* (after Comstock).

Fig. III.—A portion of diseased orange peel, highly magnified.
a. Female, after first moult.
b. Male „ „
c. Female „ second moult adult.

Figs. IV. and V.—Views of adult females, showing the different outline of the scale.

Fig. VI.—Adult, winged male (after Comstock).

CCXIII.—REDISCOVERY OF GUTTA PERCHA TREE AT SINGAPORE.

(*Dichopsis Gutta*, Benth.)

The following account of the continued existence in the island of Singapore of the original species (originally described as *Isonandra Gutta*, Hook.) from which Gutta Percha was first obtained, is translated (with some compression) from a note by M. Sérullas in the *Comptes Rendus* for September 15, 1890 (pp. 423–426).

"The existence of Gutta Percha was announced to the civilised world in 1842 by Dr. W. Montgomerie. The priority in this respect of the traveller Tradescant has not been established. In any case the first specimens which reached Europe under the name, coming from Singapore, were brought to London in April 1843 by Sir José d'Almeida.

"In bringing to light their remarkable properties no time was lost by Hancock. Wheatstone, moreover, who had been speculating since 1837 on a telegraphic union between England and the Continent, conceived the idea of employing them for this purpose, but it was not until the 10th of January 1849 that a submarine cable was first sunk by Mr. Walker in the English Channel. This cable, whose length, however, was only two miles starting from Folkestone beach, was sheathed with Gutta Percha.

"Since that time numerous attempts have been made to replace Gutta Percha for this purpose, now that the demand is so great, and it is constantly becoming more scarce and dearer every year. Hitherto they have all failed. The fact is that submarine telegraphy requires gums of the finest quality. Those of *Bassia Parkii* from Africa, and of *Mimusops Balata* from the Guianas, have only given negative results. As for that of *Payena Leevii* (Gutta Sundek), if it is in actual use to-day it is simply owing to mistake on the part of the collectors.

"The only gums which are of use as insulators for cables are produced by trees of the genus *Isonandra* (now sunk in *Dichopsis*). Their natural habitat is exclusively in the Malayan region.

"The destruction of the interesting zone of Malay forests proceeds rapidly. The natives cut every available tree, and repeat the process as fast as they spring up again ; they have thus suppressed for the last 40 years their reproduction and multiplication.

"Such gums as those used at the commencement of the industry are no longer met with except in exceptional cases. Those which have replaced them will share the same fate within the next 50 years. Little by little exportations are beginning to cease from the Malay ports. The scanty plantations started in the East Indies are moreover formed not of the better species, but of those which though rich in latex yield an inferior product. Submarine telegraphy, in point of fact, is on the eve of finding itself destitute of those plants which are indispensable to it in the present state of science, yet the source of these guttas is still imperfectly understood.

"Historically the first plant described as a source of Gutta Percha was *Isonandra Gutta*, Hooker. This is the only tree of which the coagulated latex, when sent to Europe, has stood the test of practice. It is described as extinct since 1857 in the island of Singapore, and as existing only in the Malay forests.

"In point of fact this species has become excessively rare, but it is still in existence. Its adult representatives were still propagating themselves in 1887 at Chasseriau estate in the ravines of the ancient forest of Boukett Timah, situated in the centre of Singapore, where it was discovered in 1847 by Mr. Thomas Lobb, who collected on the spot the specimens preserved in the Kew Herbarium. Except Dr. Oxley no one has since succeeded in obtaining it. The tree only flowers when 30 years old, and at intervals of two years. When I found it in 1887 any gutta collecting had ceased for the last 30 years. The extinction of the tree was supposed to be complete. Nevertheless hardly three years ago there still existed in the remnants of the ancient forests of the island adult trees of this species, represented chiefly by offshoots.

"The word 'gutta' in the Malay language is only used in the absolutely general sense of 'gum' or 'glue.' The word 'percha' does not mean merely 'Sumatra' as has hitherto been generally believed (Sumatra is called 'perxa,' which means the inhabited terrestrial world). Percha means 'rag' and exactly characterises the appearance of the gums, which before treatment with warm water resemble rags half reduced to compressed paper-pulp.

"In the Malay forests, in which I travelled for four years, I met with only five kinds of trees which could be mistaken at first sight for *I. Gutta* from their foliage, and from having a similar latex. It is impossible to confuse it with the other species of *Isonandra* which produce gutta of different quality, Gutta Sundek in this respect being intermediate.

"The Gutta Sundek of commerce is evidently a complex mixture."

CCXIV.—NEW PROCESS FOR RECOVERING LOSS OF GUTTA PERCHA.

The following correspondence gives an account of the attempts which have been made, both recently and at a later date, to recover some portion of the Gutta Percha which is left in the bark of the trees after collection by the ordinary native method.

Colonial Office to Royal Gardens, Kew.

Sir,
Downing Street, August 19, 1891.

I am directed by Lord Knutsford to enclose, for such observations as you may have to offer, a copy of a Despatch from the Governor of the Straits Settlements on a new process for extracting Gutta Percha.

I am, &c.
(Signed) R. H. Meade.

The Director of
The Royal Gardens, Kew.

The Governor of the Straits Settlements to Colonial Office.

Government House, Singapore,
July 18, 1891.

My Lord,

I have the honour to inform your Lordship that I witnessed yesterday a process for extracting Gutta Percha from the twigs and leaves of the Gutta Percha tree (*Isonandra Gutta*). It is difficult to over-estimate the importance of the invention, and this will be readily understood when I mention that the method hitherto and still in vogue for obtaining Gutta Percha is to cut down the tree and collect the juice as it exudes from the stem or trunk. This collecting of the juice of the gutta tree is solely in the hands of the natives, who search the jungles for the purpose, and I may add, as a curious detail in their proceedings, that they are reported to consider it necessary to collect the juice from the cut down tree in the dark.

2. Monsieur Eugene Sérullas, a French savant of repute, is the discoverer of the invention to which I refer. I will now describe his process as best I can. The twigs and leaves of the gutta tree, which are obtained by way, as it were, of ordinary pruning, having been brought into the store in bundles are finely chopped up. It is a matter of no moment, apparently, whether the leaves, &c. are still fresh or dead. The chopped up stuff is then treated with acid (which is the main secret of the invention) until a reddish-brown liquor is produced. This is put into an alembic, already supplied with a small quantity of water, to prevent the gutta from sticking to the sides of the vessel, and steam is applied for about twenty minutes or half-an-hour, during which the acid evaporates and is drawn off.

3. In yesterday's experiment, through a desire not to keep me waiting too long, the alembic was opened rather too soon, and the gutta therefore was not properly cooked. But there it was, rather more than one pound of it extracted from thirty pounds' weight of the chopped up leaves and twigs. When the process has been perfected it is expected that the proportion of 2 per cent. at least of pure gutta will be obtained from the raw material.

4. The demand for gutta has increased enormously since the introduction of submarine telegraph cables. It is estimated that the trade consumes 4,000,000 lbs. a year. The article forms one of the principal exports from this Colony, as much as 76,592 pikuls (=10,212,266⅔ lbs.) having been exported last year, the value of which is given at $4,946,890, or about 825,000*l.* The greater portion by far of this quantity goes to the United Kingdom, and has been imported here from Dutch India. From the Protected Native States only a little is

obtained, because, on finding that the forests were being denuded of gutta trees through the destructive system adopted in procuring the sap, a stop was put for a time to its collection.

5. A syndicate has been formed here to work out the process and to establish a factory, and, so far as I can judge, there is every prospect of a very valuable industry and most profitable concern being in their hands.

I have, &c.
(Signed) CECIL C. SMITH.

The Right Hon.
The Lord Knutsford, G.C.M.G.,
&c. &c. &c.
Colonial Office.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, August 24, 1891.

I HAVE the honour to acknowledge the receipt of your letter of August 19, enclosing a copy of a Despatch from the Governor of the Straits Settlements on a new process for extracting Gutta Percha.

2. It has long been known that both in the case of India Rubbèr and of Gutta Percha the ordinary methods in use only yielded a portion of the milk contained in the tree or vine operated upon. Where the method of tapping was resorted to this was rather advantageous than otherwise, as the tree was not exhausted by the process, and could at intervals be repeatedly tapped again.

3. Where, however, the tree was felled in order to drain it of its milk, as appears to be the case with Gutta Percha yielding trees, there can be no doubt that the residual loss was very considerable, and the corresponding irrecoverable waste very great.

4. This was carefully pointed out by Mr. Leonard Wray, junior, the Curator of the Perak State Museum, in a very important report presented to Sir Hugh Low, G.C.M.G., then Her Britannic Majesty's Resident, Perak, September 25, 1883. In this he states :—" The bark " on the upper part of the trunk and on the branches . . . is just as " rich in Gutta as the lower portion of the trunk. *Even the leaves* " *contain a notable proportion.*" He estimated that the wet bark contains fully 5·7 per cent. of Gutta Percha, and that " by simply " pounding or rasping and boiling the bark, nearly all the Gutta which " it contained may be extracted." With these facts in view Mr. Wray sent to Kew at the end of 1885 a quantity of the dried bark in order that it might be ascertained whether the residual Gutta could be extracted in this country. The investigation was undertaken, as I informed you in my letter of August 6, 1886, by the India Rubber, Gutta Percha, and Telegraph Works Company, Limited. I may quote the result :—" After a very careful study of the question they find that " though a large proportion of the Gutta Percha is undoubtedly re" coverable, it is so intermixed with a brittle resin that the resulting " product is commercially valueless."

5. This result is, however, not incompatible with the more favourable results obtained by M. Eugene Sérullas. It is quite possible that by acting upon fresh material the Gutta Percha may be obtained free from deterioration.

6. The idea, however, of obtaining the residual Gutta is not, altogether, a new one. The same problem presented itself in Demerara in the case of Gum Balata. The late Sir William Holmes attempted,

by a method, apparently, purely mechanical, to extract the Balata from the bark by means of a steam crushing mill. The process was, however, I believe, abandoned, the product being too impure for commercial purposes.

7. The method of extracting the Caoutchouc or Gutta Percha by means of a solvent is much more promising if it proves practicable, and yields a product the essential properties of which are not impaired. It is not, however, novel. In 1878, Mr. Sowerby, the Secretary of the Botanical Society of London, appears to have suggested to Mr. Thomas Christy, a plan for growing the African rubber vines "in plantations and cutting down the stems yearly." The stems were then to be crushed and digested with bisulphide of carbon in which the rubber is soluble. The subject was briefly referred to in the Kew Report for 1877 (p. 32). I do not remember meeting with any account of the method being carried out practically.

8. Gutta Percha is a substance which is at present of first-rate importance to civilisation. The trees which yield it are confined to a very limited area on the earth's surface; they are of slow growth, and I believe, at present, no steps are being taken to plant them so as to provide for the Gutta Percha supply of the future. The exhaustion of this important product would seem to be within a measurable distance. The experiments of M. Sérullas, inasmuch as, if successful, they will economise the yield, appear to me to deserve every encouragement.

I am, &c.
(Signed) W. T. THISELTON-DYER.

The Hon. R. H. Meade, C.B.,
Colonial Office.

A portion of the original report of Mr. Leonard Wray, junior, is reproduced.

Mr. LEONARD WRAY, Junr. to Sir HUGH LOW, K.C.M.G., Her Britannic Majesty's Resident at Perak.

SIR, Taaipeng, Perak, September 25, 1883.

I HAVE the honour to inform you, that in pursuance of the request you made some months ago, I turned my attention to the study of the trees from which the Gutta Percha of commerce is procured, and I now beg to present to you my report, embodying the result of those studies up to the present time, and solicit your special attention to that portion which relates to my discovery of the large quantity of Gutta Percha that may be extracted from the bark which is now entirely wasted.

* * * * * *

Method of collecting the Gutta Taban Merah.

A tree having been found, a staging of saplings tied together with roots or rattens is erected round it, so that it can be cut above the spreading buttresses. The tree is then felled with a little Malay axe, called a "billiong," and as it lies on the ground V shaped rings about one inch broad are cut in the bark, at intervals of 15 to 18 inches, all along the whole length of the trunk and of the large branches, with a heavy chopping knife called a "parang." These cuts soon become filled with the white cream like sap, and in about half an hour the Gutta will have separated from the aqueous portion of the sap, and may then be removed by rolling a small ball of it round in the cuts, to the edge of which the coagulated gum adheres and forms a disc, varying in size, according to the number of scores it is rolled in.

These discs are then boiled in water, and made into balls, and sold by the collectors to the men who export it to Penang or Singapore.

The Gutta is at first pure white, but soon changes to pink, and finally to a brownish red. The water in which the gum is boiled becomes a dark red brown, and this colouration is the most distinctive feature that this variety of Gutta possesses, and by which it may be easily recognised.

The air seems to have an analogous effect on the sap to that of rennet on milk, coagulating the gummy portions so rapidly, that only a small quantity of their watery stuff runs out of the cuts, all the Gutta Percha remaining as a soft spongy mass in the scores.

The amount of Gutta obtained from a single tree appears to have been greatly over estimated in the accounts that have been written on the subject; and exceptionally large yields from gigantic trees have been erroneously quoted as being an average product, which is clearly by no means the case.

I had a tree felled that was two feet in diameter (at six feet from the ground) and about 100 feet high, the age of which I estimated from its annular rings to be over 100 years. It gave only 2 lbs. 5 ozs. of fairly clean Gutta, valued by a Malay dealer at $1.20 per cattie or 3*s.* 3*d.* per lb., so that the product of this tree was worth only 7*s.* 6*d.*

Some say that if Gutta trees are felled in the height of the rains, and when the sap is rising strongly, they then yield more Gutta than at other times, but I have had no means of testing the truth of this assertion.

* * * * * *

Whilst engaged in collecting specimens and information respecting the Gutta producing trees of Perak, I was greatly struck by the exceedingly small amount yielded by even large trees by the present Malay method of ringing the bark, which led me to an examination of the dried bark, with a view to ascertain, by a series of careful experiments, what proportion of the whole amount of Gutta contained in a tree was actually left in the bark after the usual process of extracting it had been performed. With this object, I had, on the 24th of May 1883, a tree of Gutta Taban Simpor felled, and scores cut in the bark, at distances of 15 inches along the whole length of the trunk, and obtained 12 ozs. of Gutta. Some two or three days after, I had some of the bark removed, and on the 29th I cut some of it up into thin slices across the grain, and boiled them in water for a short time, when I found that Gutta had been expelled, and remained as a slight and irregular coating on the chips. This I picked off, and weighing it I found the yield to be 3½ per cent. of the weight of the wet bark operated. Encouraged by this simple and satisfactory experiment, I next had a weighed sample of bark pounded in a mortar, and then transferred it to a glass vessel, and boiled it in water. In a few minutes the Gutta formed itself into small detached white flakes, and by stirring collected into a mass, which was easily removed from the flask, and purified by re-boiling in clean water. By this method, the sample of wet bark yielded 5·3 per cent. of clean white Gutta. Another weighed sample of bark was cut up and dried in the sun, and then put into chloroform, and after standing some hours, with frequent shakings, the liquid was poured off and allowed to evaporate, fresh chloroform being added to the bark to extract any Gutta which remained in it. The total product thus obtained was 5·7 per cent. of the weight of wet bark used in the experiment. I next took a weighed sample of wet bark and cut it up into small chips, and dried it thoroughly, and found as the result of several experiments that it lost 50 per cent. of its weight in the process. The following deductions may be made from these results, firstly, that the wet bark which is now allowed to rot in the jungle contains fully 5·7 per cent. of its weight of Gutta Percha, or when dried 11·4 per cent.; and secondly, that by simply pounding or rasping, and boiling the bark, nearly all the Gutta which it contains may be extracted.

After the tree was felled I made careful measurements of it, and weighed portions of the bark, so that I could calculate the total weight on the trunk of the tree up to the first branch, which I found to be 530 lbs. when in the wet state. Now, if we take 5·3 per cent. of this as being the amount of Gutta that may be extracted by the process of pounding and boiling, already specified, we find that it would yield 28 lbs. over and above the 12 ozs. which was obtained by the ordinary Malay method, or to put it in another way, that for every lb. of Gutta collected at present, 37 lbs. are wasted!

In the Kew Report for 1881 I find it stated that in the year 1875 the export of Gutta from the Straits Settlements and Peninsula was estimated at 10 millions of pounds weight. I have no means of ascertaining the accuracy of that estimate, but accepting it as being tolerably correct, we must, from my experiments, come to the conclusion that even if we take the amount of Gutta wasted at only 30 times weight of that collected, there were during that one year no less than 300 millions of lbs., or, putting the price at only 2*s.* 6*d.* per lb., 37,500,000*l.* sterling worth of Gutta Percha thrown away, and utterly lost.

To fully realise the importance of this subject, it must be borne in mind that this vast destruction of these valuable trees (which are of such very slow growth) and of this material, on which the communication of the world may be said in a measure to depend, is going on every year, without any cessation whatever. It will be noticed that I have left out of my calculations all the bark on the upper part of the trunk, and on the branches, which, however, is just as rich in Gutta as the lower portion of the trunk. Even the leaves contain a notable proportion! I have tested also other varieties of these trees, and have obtained almost identical results, therefore I need not enter into further details. The question naturally arises, can the bark be taken from the trees and dealt with in the country, or can it be dried and sent to Europe, to be ground up and treated in the manner I have described, or in some other way sufficiently economical as to be commercially successful? This question deserves the most anxious attention, especially of those who are engaged in the working up of this material, for if it can be successfully accomplished, then the same supply could be furnished with one thirtieth of the present annual destruction of trees!

With the object of having this point so far tested, I have collected some bark, and am sending it to the Royal Gardens at Kew, with a request to have it sent to one of the large manufacturers, so that a report may be obtained from them on the subject. The labour involved in stripping the trees, carrying out the wet bark from the jungles (where no roads nor even paths exist), drying it, carrying it to a port and thence to England, are items of expense which must not be overlooked! At the same time, it must also be remembered that some other jungle products, quite as bulky, and not so valuable, are yet exported with profit.

If the Gutta contained in the bark can be profitably extracted, the planting of those trees on waste lands might possibly be undertaken by Government, with every prospect of success. The variety that seems to be most easily grown is *Payena Leerii* (Gutta Sundeh). This tree fruits freely, and will thrive on the swampy plains near the coast, and is said by the Malays to grow fast. Its wood is hard, with a close grain, and takes a good polish, therefore may be of some value as timber. I have tried experiments in making cuttings of some species of *Dichopsis*, but have not had any success as yet, although it is probable that they may be propagated by this means, when the proper mode of effecting it is found out. I have not tried *Payena Leerii* as yet, but hope to be able to do so very shortly.

I have, &c.

(Signed) L. Wray, Junr.

The following correspondence gives the results obtained from the material sent home by Mr. Wray :—

The India Rubber, Gutta Percha, and Telegraph Works Company, Limited, to Royal Gardens, Kew.

106, Cannon Street, London, E.C.,
August 5, 1886.

Sir,

Referring to your letter of the 11th June, which was acknowledged on the 16th of the same month, I beg to send you enclosed a report from our analytical chemist on experiments carried out by him with the Gutta Percha bark which you forwarded to us. You will notice that we obtained 13·6 per cent. of gutta and resin, which agrees fairly well with the analysis of Mr. Wray, who gives the proportion as 11·4 per cent.

There is no doubt that there is a considerable quantity of resin in the sample which I enclose. The presence of this resin diminishes the commercial value of the gum to such an extent that there is, so far as we see, no profitable outlet for it. I would also draw your attention to the chemist's report where he says : " It is very improbable whether " its recovery by means of solvents would be remunerative, as the " necessary loss in treating such large quantities of accompanying " useless matter would be very great." Our decision is therefore that the material is practically useless.

Regretting we cannot give a more favourable report.

Yours, &c.

(Signed) Robert Kaye Gray,
Engineer in Chief.

W. T. Thiselton-Dyer, Esq., C.M.G., F.R.S.,
Royal Gardens, Kew.

[Enclosure.]

Mr. Thos. T. P. Bruce Warren, Analytical Chemist, to the India Rubber, Gutta Percha, and Telegraph Works Company, Limited.

Dear Sir, Silvertown, E., August 4, 1886.

We have examined the bark of a tree referred to in letter from W. T. Thiselton-Dyer, Esq., dated June 11th.

Our examination has been principally directed to the following points, viz., whether the extraction of Gutta Percha from the same could be made remunerative as a commercial venture, and whether there is any probability of its meeting with a specific application which may give it a commercial status.

As a source of Gutta Percha many points have to be considered, apart from the quality of the Gutta Percha which may be obtained from it.

The most apppropriate method for extracting the Gutta Percha from it, is in treating the crushed bark with a suitable solvent of a volatile nature, so that the recovery of the soluble matter may be attended with little chance of alteration in his physical properties.

The crushed bark thus treated yields 13·6 per cent. to bisulphide of carbon. On evaporating the solvent a residue is obtained, which hardens on cooling, and softens in warm water; in fact, in these respects it strongly comports itself to Gutta Percha; in colour and tenacity it is unlike any description of ordinary good Gutta Percha.

It is very improbable whether its recovery by means of solvents would be remunerative, as the necessary loss in treating such large quantities of accompanying useless matter would be very great.

The want of tenacity in the product obtained is due to the presence of a brittle resin, which also contributes to the facility of softening at a low temperature. The difficulty of manipulating the same by any ordinary appliance used in treating Gutta Percha or India Rubber, adds to the difficulty of suggesting a probable field in which its properties would be appreciated.

I am, &c.

(Signed) THOS. T. P. BRUCE WARREN.

Robert Kaye Gray, Esq.,
106, Cannon Street, E.C.

ROYAL GARDENS, Kew, to COLONIAL OFFICE.

SIR,

Royal Gardens, Kew, August 6, 1886.

I HAVE the honour to inform you that Mr. Leonard Wray, junior, Curator of the Perak Museum, addressed September 25, 1883, a very valuable report to Sir Hugh Low, K.C.M.G., Resident in that State, upon the Gutta Percha yielding trees indigenous to it.

In this report he set out grounds for believing that no less than 30 times the amount of Gutta Percha actually extracted by the process of felling remained in the tree and was thereby wasted.

Struck with this fact he was anxious to ascertain if any part of this enormous residue could be extracted from the dried bark after removal from the tree.

As will be seen from the accompanying correspondence four barrels of bark of one of the species were despatched to Kew for the purpose of obtaining a report upon the question.

The India Rubber, Gutta Percha, and Telegraph Works Company, Limited, as in so many other cases, obligingly assisted this establishment in the matter.

I regret to say that after a very careful study of the question they find that though a large proportion of the Gutta Percha is undoubtedly recoverable, it is so intermixed with a brittle resin that the resulting product is commercially valueless.

Unfortunate as is this result it by no means diminishes the credit due to Mr. Wray for his thoughtful suggestion.

As the question involved is one of the greatest interest, I venture to hope that you will think it advisable to communicate copies of the correspondence to the Government of the Straits Settlements, by whom they will, no doubt, in turn, be transmitted to Sir Hugh Low.

I am, &c.
(Signed) W. T. THISELTON-DYER.

The Hon. R. H. Meade, C.B.,
Colonial Office, Downing Street, S.W.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, August 17, 1886.

I AM directed by the Secretary of State for the Colonies to acknowledge the receipt of your interesting letter of the 7th inst. respecting the Gutta Percha yielding trees of Perak, and to inform you that a copy of it has been sent to the Governor of the Straits Settlements.

I am, &c.
(Signed) ROBERT G. W. HERBERT.

The Director, Royal Gardens, Kew.

CCXV.—TAGASASTE.

(*Cytisus proliferus*, Linn.)

The following account of this useful fodder plant is reproduced from the Kew Report for 1879, p. 18.

We are indebted to Dr. G. V. Perez for seed of this forage plant (*Cytisus proliferus*, var.). It is a shrub indigenous to the Canaries, the leafy branches of which are said to be a useful fodder. It requires a light dry soil, and is rather intolerant of frost in winter. The plants should be placed six to ten feet apart, may be cut two or three times a year, and will last 10 to 20 years. Thirty-five pounds of fresh chopped Tagasaste, mixed with 20 lbs. of chopped straw, is said to be sufficient for the daily nourishment of a horse or cow. The seed is very slow in germinating. It was pretty widely distributed from Kew.

CIRCULAR from ROYAL GARDENS, KEW, to COLONIAL GOVERNMENTS.

Royal Gardens, Kew,
July 18, 1879.

SIR,

I AM sending you, through the Colonial Office, a packet of seed of Tagasaste (*Cytisus proliferus*, var.). This is a shrub, a native of the Canaries, the leafy branches of which are said to be a useful fodder. It requires a light, dry soil, and is rather intolerant of frost in winter. The plants should be placed six to ten feet apart, may be cut two or three times a year, and will last 10 to 20 years. The seeds are very slow in germinating.

I am, &c.
(Signed) W. T. THISELTON-DYER.

1879. Extracts from Kew Report.

Madras.—Most of the seedlings died off after germination. Colonel Grant reports at commencement of present year:—"At present only "two or three are looking healthy, and from them I should think very "little fodder would ever be obtained."

South Australia.—Dr. Schomburgk reports from Adelaide:—"The "seeds were sown and all came up. The growth of the plant is "vigorous, some of the plants having reached two to three feet, "looking healthy, not in the slightest degree affected by the severe dry "weather we have had to contend with. I have many plants for "distribution."

The Administrator of the Transvaal to Royal Gardens, Kew.

Government House, Pretoria, Transvaal,
September 7, 1879.

Sir,

I have the honour to acknowledge and thank you for your letter of July 18th, together with the accompanying packet of seeds (Cytisus proliferus, var.) which arrived safely.

The seeds have been distributed in various districts of the Colony for the present sowing season, and I shall have much pleasure in communicating to you at a future date the particulars of their growth and progress.

I have, &c.
(Signed) W. Owen Lanyon,
Administrator.

W. T. Thiselton-Dyer, Esq.,
Royal Gardens, Kew.

1880. Extracts from Kew Report.

Adelaide.—Dr. Schomburgk reports:—"The seeds have grown "uncommonly well, the plants reaching a height of four to five feet. "There is not the slightest doubt that this plant delights not alone "in our climate, but in any kind of soil and situation . . . . . I "do not doubt a moment that this shrub if sown on the sheep runs, "naturally well covered with soil, will soon become acclimatised, and "will stock the runs with a new fodder plant."

Brisbane.—In these gardens the seed germinates freely in the open air, but makes but little progress in its subsequent growth.

1881. Extracts from Kew Report.

Ootacamund.—Mr. A. Jamieson, Superintendent of the Botanical Garden, reports, July 7, 1881:—"Nothing could be more satisfactory "than the growth this plant has made during the past year. Several "dozens of plants put out in a bed of stiff, rather poor soil, have "made a wonderfully rapid growth, many of them being 15 feet "in height, and are well furnished with branches, which are covered "with succulent healthy foliage. I have tried milch cattle, sheep, "goats, &c. with it; sheep and goats eat it greedily; cattle eat "it, but do not seem to care for it much. I have no doubt, how- "ever, if they were persistently tried with it they would partake of "it freely. The plant is perfectly hardy, and is not affected by frost

" or drought, and I feel certain would thrive in many parts of these " hills, where nothing else of any value as a fodder would succeed. " The plants are coming into flower, and will probably yield a quantity " of seed by the autumn."

1882. Extract from Kew Report.

Adelaide.—Dr. Schomburgk reports:—" I must again especially " recommend to the squatter the 'Tagasaste,' which has found a most " genial climate in South Australia. The dry season has not shown " the slightest effect on the plants. If the seed be sown on the runs it " would soon become acclimatized, and would stock them with a profitable shrub capable of withstanding the severest drought. Although " I offered seed of the 'Tagasaste' for distribution, only a few applications have been made in South Australia, but a large number were " received from the neighbouring colonies."

In 1886 the merits of Tagasaste were again brought into notice through the Foreign Office.

British Consulate, Teneriffe, to Foreign Office.

My Lord, Teneriffe, September 1, 1886.

Dr. Victor Perez, a Spanish gentleman residing in this island, who devotes much of his time to agricultural pursuits, mentioning to me the suitability and nutritive qualities of a certain kind of grass, the " *Cytisus proliferus*, varietas," and highly recommending it as an all the year round food for horses and cattle, I obtained from him a sample (forwarded separately in a canvas bag) and descriptions herewith enclosed of the grass or hay, which, in the interest of the trade in England, and in pursuance of the Foreign Office Circular of 31st July last, I beg leave to submit to your Lordship as a commercial item for the information of Chambers of Commerce and others interested in such matters.

I have, &c.

Her Britannic Majesty's (Signed) J. Hutton Dupuis,
Secretary of State, Foreign Affairs,
Foreign Office, London.

Description of the Tagasaste by Dr. Victor Perez.

A shrub, a native of the Island of Palma, the precise site where it grew originally being on the hills above the celebrated Chapel of *Our Lady de las Nieves*, at a height of one thousand *metres* above the sea level.

Taken from there to other parts of that island by native farmers, it soon obtained great repute for feeding cattle.

Introduced into Teneriffe by Dr. Victor Perez he made known its properties in a pamphlet published in 1865, " Apuntaciones sobre el Tagasaste por el Dr. Victor Perez, Santa Cruz de Tenerife, 1865."

Since then Dr. Perez has made a special study of this plant, and has published in 1867 and 1879 the results of his observations.

At present its suitability as green food for cattle is undoubted, and it is certainly superior to any other known. During the last two years

Dr. Perez has made fermented hay after the German style (*see* sample sent).

Fermentation produces a sweet principle which makes it particularly palatable to horses and ruminants, so that during the rainy or winter season, in which there are no other plants for food, the Tagasaste should be stored as hay, the more so, as it can be cut several times during the year, and that during the summer it is perhaps more luxuriant than ever.

Sheep taken from the pastures to Santa Cruz awaiting shipment, and there submitted exclusively to Tagasaste hay as food, gained in weight; the quantity of hay allotted to each was 2 lbs.

Horses do remarkably well with it alone; they also take it mixed with chaffed straw.

Its cultivation deserves of every attention being paid to it, and once its nutritive properties being made known by analysis and experience, it may become an article for exportation and a great resource for farmers in Teneriffe and the other islands where they know not what to cultivate at present with profit.

Dr. Perez has sent some seeds to Kew and to Paris. It could grow well at the Cape of Good Hope, and at Algiers, and in other countries whose climate resembles that of the Canaries.

Its great value is manifest from the fact that it requires no irrigation, that it can grow in comparative barren land up to a height of about 4,000 feet, and above all, that its branches can be cut off *three* times during the year, resisting perfectly well a long dry summer. It lives a great many years and produces from the second or third.

|1888. Dr. SCHOMBURGK reports from ADELAIDE:—

* * * * * *

The Tagasaste has found a most suitable and congenial climate in South Australia, flourishing alike in wet and dry seasons. I have frequently called attention to the value of this plant in my reports of previous years, and during that time have distributed seeds for cultivation. It seems to me that in matters of this kind, both the pastorists and agriculturists have hitherto shown a most remarkable degree of apathy. The Tagasaste requires but little trouble in cultivation; it readily adapts itself to the climate, and with a small amount of exertion would soon stock any run into which it might be introduced with a profitable fodder shrub. I am glad to say that, recently, applications from farmers for seed are on the increase. For the benefit of those who are inclined to profit by the experience afforded by the late drought, I once more recapitulate the valuable qualities of the Tagasaste as well as the mode of treating it.

The seed may be sown broadcast in the usual way, but, before sowing, it is well to soak it for a few hours in hot water so as to soften it, and allow it to germinate the more freely. When the plants come up too freely they should be thinned out, and those which are removed may be planted out elsewhere. They should stand 8 feet or 10 feet apart. For the first two years the shrub does not attain its fullest development. In the third year a large foliage is obtained, which becomes permanent. After the third year the plants should be cut from 2 feet to 3 feet from the ground, so that they may become bushy. They may be cut twice or thrice a year, according to their growth.

Tagasaste has the advantage of containing a large quantity of nitrogenous matter. It is estimated to contain 1·136 of nitrogen against 1·028 in an equal quantity of first class clover hay. Each 100 lbs. of Tragasaste fodder is calculated to produce 2·60 lbs. of flesh. Animals fed upon it come into condition more rapidly and in a greater degree than with any other sort of food, except corn.

It is said that animals in Madeira fed on Tagasaste so mixed, fatten more rapidly than with any other fodder, or than with hay. This is thought to be due to the presence in the plant of an essential oil, which retards the waste of tissue, and so promotes fattening. The very favourable accounts which are given of this plant are such as ought to induce farmers to try it. Considering that the most severe drought does not affect it at all, it would be advisable for every farmer to plant every spare corner of his land with Tagasaste.

1889. W. HUTCHINS, Conservator of Forests, writes in the JOURNAL OF THE CAPE DEPARTMENT OF AGRICULTURE:—

Tagasaste is sown in 8 or 10 of the forest nurseries in the forest country north of King William's Town. The seed was obtained partly in the colony and partly from Paris. Both samples of seed germinated equally well. A good deal of it was eaten down by insects during the stormy weather of the summer rains, and it does not appear to be hardy against either frost, drought, or the weeds of the country, but when kept in the nurseries and cared for it grew well. I am informed that its progress since I left that part of the Colony is good.

EXTRACTS from REPORT of ADELAIDE BOTANIC GARDEN (p. 6).

Dr. Schomburgk* writes:—I feel it desirable once more to direct attention to the Tagasaste. It seems that its value as a fodder plant is fully recognised in the neighbouring colonies. In a letter from Mr. G. Kuch, from Gippsland, to whom I forwarded some of the seed, that gentleman writes as follows:—"It is now four years since I sowed "the seed of the Tagasaste, and the shrubs have reached a height of "from 13 feet to 14 feet. The branches have been clipped several times "during the summer months. The clippings are eaten with great "avidity by cattle and sheep. After clipping, the branches soon start "growing again. The shrub appears to thrive better in sandy soil, and "to grow more vigorously than in heavy ground. It possesses another "property, which will be of immense value to apiarists in places where "it is cultivated: it flowers from May to September; during this "period, when flowers are very scarce, its blossoms are plentiful, and "the shrub is frequented by swarms of bees. I consider it to be one of "the most valuable trees ever introduced into Australia." No doubt Tagasaste is most valuable to those engaged in bee-culture. Indeed, I can confirm Mr. Kuch's statement in this respect, for the trees that are in the Botanic Garden are covered with bees during the flowering season.

Mr. FREDERICK TURNER, Botanist to the Department of Agriculture, New South Wales, reports adversely:—

A Canary Island shrub called Tagasaste is now occupying much attention in some quarters, which experience will eventually prove to have been misdirected. I have observed this shrub for a number of years, having raised from seed some of the first plants ever seen in Australia. I have a shrub now under my charge which is about 15 feet high, but I can firmly assert that an old man salt bush (*Rhagodia parabolica*) would at the same age have produced about twice the amount of a superior fodder, and would grow in even more adverse circumstances of drought and heat.

---

* It is with great regret that the death must now be recorded of the accomplished Director of the Botanic Gardens, Adelaide, on the 24th March 1891, aged 80.

EXTRACT from the REPORT of the DURBAN BOTANIC SOCIETY.

In my report for 1889 I gave some particulars about this plant, and by the kindness of Messrs. Miller & Co., of Las Palmas, I obtained a bag of seed for distribution. This was divided into packets, each containing enough to plant about half an acre of ground, and of these packets 72 have been sent out free to applicants, chiefly in the midland and upland districts, including five to Transvaal. It succeeds well in all parts of Natal. A correspondent in Madeira, where the plant has been lately introduced, says:—" It is now thriving well with us, and " sheep are simply mad for it. It thrives in the summer heat without " watering, and I am obliged to keep the sheep off it until it gets high " enough to be out of their reach so as to give it breathing space. The " cattle like it, and when overgrown it gives firewood, green manure, " &c. Its light shade encourages the grasses in dry weather. I " consider it one of the best fodder and all round plants that have ever " been introduced here."

CCXVI.—KANGRA BUCKWHEAT.

(*Fagopyrum tataricum*, var.)

In January 1890 there was received at Kew a packet of seed of a particular kind of Indian Buckwheat which differed in some respects from the ordinary sorts of *Fagopyrum tataricum*, Gærtn. Mr. J. F. Duthie, F.L.S., Director of the Botanical Department of Northern India, from whom the packet was received, was good enough to supply some interesting particulars respecting the origin and characteristics of this buckwheat. The ordinary buckwheat (*Fagopyrum esculentum*, Mœnch.) is extensively cultivated on the Himálaya, where it forms a rainy season crop, being sown in July and reaped in October. The buckwheat of the higher Himálaya appears to be *Fagopyrum tataricum*, Gærtn. The Kángra Buckwheat is a variety of this latter species.

DIRECTOR OF THE BOTANICAL DEPARTMENT, Northern India, to ROYAL GARDENS, Kew.

Camp, Chanda District,
Central Provinces, India,
December 19, 1889.

MY DEAR DYER,

I AM sending you a packet of a particular kind of Buckwheat, *Fagopyrum tataricum* (var. nov. according to Regel). A sample of this kind was sent from Saharunpore to St. Petersburg in 1878, along with numerous other seeds and vegetable products which were collected on the occasion of the Paris Exhibition. Professor Batalin, of the Imperial Botanic Garden, wrote to me some months ago asking me to send him a large quantity of this buckwheat for trial cultivation in Russia, observing that this particular variety was not known in Europe, and that the core being light and loose it was suitable for the preparation of groats. As no record was kept as to the locality from which the original sample was obtained, I had some difficulty in getting hold of it, but at last received a sample from a place on the Punjab Himalaya above Kángra. As the seed is quite fresh I think perhaps you may wish to sow some at Kew, and retain a portion of it for the Museum.

Yours, &c.
J. F. DUTHIE.

CCXVII.—MISCELLANEOUS NOTES.

The Secretary of State for the Colonies has appointed, upon the nomination of Kew, Mr. C. A. Barber, B.A., late scholar of Christ's College, Cambridge, and University Demonstrator in Botany, to be Superintendent of the Botanical and Agricultural Department in the Leeward Islands.

The Secretary of State for India in Council has appointed, on the nomination of Kew, Mr. A. B. Westland, late Assistant to the Superintendent of the Botanical and Afforestation Department, Hong Kong, to be Superintendent of the Taj Gardens at Agra, N.W. Provinces, India.

The Secretary of State for the Colonies has appointed, on the nomination of Kew, Mr. W. J. Tutcher, Sub-foreman in the Royal Gardens, to succeed Mr. Westland as Assistant to the Superintendent of the Botanical and Afforestation Department, Hong Kong.

Dr. N. L. Britton, of Columbia College, New York, has presented to the Herbarium of the Royal Gardens a further batch of about 450 species of western South American plants which he is publishing from time to time in the "Bulletin" of the Torrey Club.

The Herbarium formed by a Moravian missionary named Bernhard Schmid, in the Nilgiris, about the middle of the first half of the present century, has been acquired by exchange from Dr. Stahl of Jena. It is valuable for the types it contains of two decades of plants published by Zenker, 1835–1837.

Mr. G. H. Garrett, a travelling Commissioner, has presented a small but interesting collection of economic plants from Sierra Leone, with notes on their uses and habitats.

Captain J. Donnell Smith of Baltimore has presented a set of the plants collected by himself last year in Guatemala. As in previous collections, the specimens are in excellent condition, and they represent about 670 species.

A large collection of Malayan plants has been received from Dr. King of Calcutta. They are mostly new species described by him in his "Contributions to the Botany of the Malayan Peninsula."

The Hon. D. F. A. Hervey, Resident Councillor, Malacca, has presented a collection of about 500 species made by himself in Malacca.

Among Cryptogams the most important additions to the Herbarium are a set of *Nostochineæ*, from Prof. C. Flahault, and various Australian Fungi from Sir Ferdinand Mueller, K.C.M.G. Professor Flahault's gift is valuable in connexion with his recent monograph.

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

Nos. 58–59.] OCTOBER and NOVEMBER. [1891.

CCXVIII.—CHINESE FIBRES.

Under the name of jute or hemp there are included a number of commercial fibres in China yielded by very different plants. There are different fibres bearing the same name, and the same product often bears different names at different ports. The fault is probably due to the fact that European traders have used the terms jute and hemp in a generic sense rather than a specific one. There is probably also a fiscal element concerned, as the duty on "jute" is only "2 mace per picul," whereas "hemps" pay 3½ mace. An inquiry made by Kew less than a year ago in regard to the origin of Chinese jute, as quoted in the London trade lists, has brought out very forcibly the confusion which exists in regard to the origin and classification of commercial fibres at Chinese ports.

It has been shown that Chinese jute, identical in all respects with, Indian jute, and yielded by the same plant, *Corchorus capsularis*, L., is grown and prepared in the neighbourhood of the town of Wênchow while the so-called jute of Northern China is obtained from an entirely

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Fourpence.

different plant which has been lately identified, from specimens forwarded to Kew by the Acting Consul at Chefoo, Mr. Alexander Hosie, as *Abutilon Avicennæ*, Gærtn. In regard to the application of the term hemp this appears to be still more widely and loosely used. It is applied, in its usual sense, to the common or Russian hemp, grown in Northern China, the produce of *Cannabis sativa*, L. It is also indifferently used and applied to the China grass or Rhea fibre (*Boehmeria nivea*, Hk.) of Kiukiang, to the fibre prepared from the bark of young trees of *Sterculia platanifolia*, L., at Hupeh, and to the pine-apple fibre (*Ananas sativus*, Baker) of Kiungchow, Hainan, and Formosa.

The application of such well-established terms as jute and hemp to fibres so different in character and origin must lead to much confusion and tend to retard the development of trade. One of the most interesting of Chinese fibres is that derived from the Ko plant, a trailing vine identical with *Pueraria thunbergiana*, Benth. This fibre, known locally as Ko-pou, has also passed under the name of hemp, although the quantity produced is apparently very small. An account of this Ko plant is given in the *Enumeration of Chinese Plants*, Journ. Linn. Soc., vol. xxii., p. 191.

To return to the subject of jute. Seeds and specimens of Chinese jute from South Manchuria received at Kew in 1879 through Mr. Arthur Davenport, Her Majesty's Consul at Shanghai, proved to belong to *Abutilon Avicennæ*, Gærtn. Fibre yielded by the same plant was forwarded to Kew in 1885 by Mr. W. M. Cooper, Her Majesty's Consul at Ningpo. The very complete set of botanical specimens, with fruits and seeds, recently received through the Foreign Office from Mr. Alexander Hosie, Acting Consul at Chefoo, has already been noticed. These specimens, with the full report furnished by Mr. Hosie, afford very conclusive information respecting the origin of the so-called jute of Northern China. This may now be more correctly called Abutilon Hemp. Another set of specimens, illustrative of the pine-apple fibre (also called hemp) has been received from Mr. E. H. Parker, Her Majesty's Consul at Kiungchow in Southern China.

The detailed information, so far obtained respecting the distribution and origin of Chinese jutes and hemps, is given in the following correspondence. It is desirable to place this information on record as a basis for the further inquiry which is in course of being undertaken at Chinese ports under the direction of Sir Robert Hart, G.C.M.G., Inspector-General of the Chinese Imperial Maritime Customs. The very interesting memorandum prepared by Dr. Henry, F.L.S., is of special value for the purpose of aiding in such an inquiry, and this establishment is greatly indebted to Sir Robert Hart for the copy of it communicated in the form of a pamphlet—China, Imperial Maritime Customs, II.:—Special Series: No. 16, 1891.

Inspectorate General of Customs, Peking,
December 27, 1890.

An inquiry respecting "Chinese jute" having been made by the Director of the Royal Gardens at Kew, Dr. Augustine Henry, one of the Service Medical Assistants now on leave, who has paid considerable attention to botanical subjects, prepared a memorandum on the jute and hemp of China, setting forth the present extent of our knowledge, and formulating certain points for elucidation. The original inquiry and the subsequent memorandum are hereto appended, and the ports concerned are requested to keep the matter in view and, while supplying the Inspector-General with such reports as may be drawn up, forward to the Non-Resident Secretary for the Kew Gardens such specimens as can be procured.

By order,
(Signed) E. B. DREW,
Chief Secretary.

ROYAL GARDENS, KEW, to the NON-RESIDENT SECRETARY.

SIR, Royal Gardens, Kew, October 9, 1890.

I AM desired by Mr. Thiselton Dyer to inform you that a sample of "China jute," a small portion of which is enclosed herewith, has lately been presented to the Museum of Economic Botany at Kew. This "jute," we take it, is prepared and shipped from some part of China, but we are unable to trace its origin.

2. This establishment takes a special interest in the industrial application of plant products, and we have received very valuable aid from time to time from officers connected with the Department of the Chinese Imperial Maritime Customs, for which we are very grateful.

3. In the present instance, Mr. Thiselton Dyer would esteem it a great favour if Sir Robert Hart could assist him in obtaining dried botanical specimens of the plant which yields "China jute," together with some particulars respecting the methods pursued in preparing it for market. The botanical specimens should, if possible, consist of leaves, flowers, and fruit, placed between sheets of paper and strengthened by cardboard. In this manner they would travel very well by parcel or book post.

I am, &c.
(Signed) D. MORRIS,
Assistant Director.

J. D. Campbell, Esquire, Secretary, Chinese Imperial Maritime Customs, 8, Storey's Gate, St. James's Park, S.W.

MEMORANDUM on the JUTE and HEMP of CHINA, by Dr. AUGUSTINE HENRY, F.L.S.

I have read over the letter addressed to the London Office by Mr. Morris, of Kew, and I think the specimen referred to "China jute" is not jute at all, but Abutilon hemp. I am also of opinion that the article comes from Tientsin.

As the Director of the Royal Gardens at Kew seems anxious to obtain information concerning the plants producing textile fibres in China, and as there is much doubt regarding the various kinds of so-called hemp and jute in China, different products bearing the same name, and the same product having different names at different ports, I take the present opportunity of preparing a statement of the extent of our present knowledge of the subject. While, on the one hand, this statement might assist the Director at Kew in showing him the direction in which information is to be sought; on the other, it may be of some service to the Inspector-General at any time that he may wish to have the subject gone into by his officers in China. The subject is of considerable importance, I should say, both on the commercial and scientific sides.

A.—*The Plants producing Textile Fabrics in China.*

In Chinese the character *Ma* is generic of plants producing textile fabrics; and the following kinds are distinguished both by colloquial and book usage [*Ma* also includes certain plants the seeds of which are used for their oil, and also certain herbs the foliage of which simulates hemp in appearance; but with these we have at present nothing to do]:—

1. *Ta Ma*, of books; *Hsiao Ma*, colloquially in North China, because there the castor-oil plant is spoken of as *Ta Ma* ("large *Ma*"), from its stature; *Huo Ma* colloquially in South China.

These names indicate common or Russian hemp, the product of *Cannabis sativa*, L.

So far as my experience in Hupeh goes, this plant is chiefly cultivated there for the oil from its seeds, and for coarse fibres used in making cordage; and is not apparently used for making cloth or canvas. But in other provinces of China it doubtless is manufactured into cloth, and information on this point is desirable.

2. *Ch'ing Ma.*—This is Abutilon hemp, the product of the plant known to botanists as *Abutilon Avicennæ*, Gærtn. It is commonly cultivated in Hupeh and Szechwan, and is the greater portion, if not all, of the "hemp" passed through the Ichang Customs. According to Bretschneider, it is also cultivated in Chihli; and I have little doubt it is what is passed through the Tientsin Customs as "jute." In support of this I find in a Customs publication that all the hemp exported from Tientsin is called by the Chinese *Ch'ing Ma*, and by the foreign merchants "jute." But there is some confusion between this and the next article, as will be shown.

3. "*Huang Ma.*"—This is "Indian jute," the product of *Corchorus capsularis*, L. The plant is figured in Chinese books, and, according to the Vienna Exhibition Catalogue, its fibre is exported from Shanghai. Loureiro mentions it for Canton, and Dr. Faber says it is cultivated in Szechwan under the name *Pai Ma.* This name is given in the Chinese Herbal, the *Pên-ts'ao* as a synonym of *Ch'ing Ma;* and it would seem, then, that Abutilon hemp and jute are liable to be confused by the Chinese. Perhaps some of the Ichang and some of the Tientsin export may be "Indian jute."

4. *Ch'u Ma.*—This is *Boehmeria nivea*, Hook. et Arn., Rhea fibre or China grass, out of which most of the so-called Grasscloth (in Chinese "*Hsia Pu*") is made. It is cultivated in Szechwan, Hupeh, Kiangsi, and various other provinces. The Kiukiang Trade Reports for 1868, p. 29, and 1869, pp. 115, 118, give the information that the "hemp" exported from Kiukiang is produced in the districts of Shui-ch'ang in Kiangsi, Hsing-kuo and Wusüeh in Hupeh, and, besides what is exported, a large quantity is locally woven into grasscloth. The 1869 Report, p. 118, enters into the question of grasscloth and its manufacture from the "hemp," and gives tables showing the extensive exportation, &c.

From this it would seem that the "hemp" exported from Kiukiang is really Rhea fibre; and I believe a large portion of the Hankow export of "hemp" is the same fibre.

The Paris Exhibition Catalogue, No. 1673, Hankow, gives *Ssŭ Ma.* This probably is also Rhea fibre.

5. *Hu Ma.*—This is flax (*Linum usitatissimum*, L.) which is cultivated in Shansi, in Mongolia, and in the mountainous parts of Hupeh

and Szechwan. In the last two provinces, from personal observation, flax would seem to be entirely cultivated for the seeds, which are a common article in Chinese drug shops, and are used locally for their oil, utilised for cooking and lighting purposes.

So far as I know, the Chinese do not make any linen.

6. *T'ung Ma*, a local product of Hupeh, and of no commercial importance.—It consists of the fibres obtained from the bark of young trees of *Sterculia platanifolia*, L. f., by steeping them in water. This "hemp" is used for making cordage, and a specimen of it, procured by me, is in the Museum at Kew.

7. *Po-lo Ma*, "Pine-apple Hemp."—This is made into a fabric called *Huang-li Pu* in Formosa (*huang-li* being the local name there for "pine-apple"). The Customs Report for 1876, Takow, p. 98, says this is a strong coarse fabric made from the fibres of the pine-apple leaf, and it resembles the coarser kinds of grasscloth. It is used (in Formosa) almost entirely in the manufacture of inner garments and of the single garment worn by agriculturists in the warm weather.

The Kiungchow Report for 1883, p. 361, says that hemp was exported from Hainan by steamer in that year to the value of Hk. Taels 18,000 (803 piculs in quantity), and that most of this so-called hemp, which is in reality the fibre of the pine-apple plant, finds its way to Swatow, where it is manufactured into a very fine grasscloth.

The export called "hemp" from Hainan and Formosa is evidently, then, the fibre best distinguished as "Pine-apple Hemp."

8. *Fan Pu*, *i.e.*, "Savage Cloth."—This is, according to the Takow Trade Report for 1876, p. 98, a kind of grasscloth worn by the inhabitants of Formosa. It is manufactured by the aborigines, and is finer and more expensive than the Pine-apple cloth. It is sold in the shops of Taiwan-fu; the better kind sells for as much as 8 dollars for a piece, sufficient for making a single garment.

It is very desirable that information should be obtained regarding the plant from which this dear article is produced. Particulars regarding its mode of preparation, &c., are also wanted.

B.—*Concerning the different Names of these Textiles in common Use, and their Export from the various Treaty Ports.*

We find the following information embodied in various Customs publications:—

1. The "hemp" exported from Tientsin is called "jute" by the foreign merchants there, and *Ch'ing Ma* by the Chinese; and is allowed to pass at the rate of 2 mace per picul, other kinds of "hemp" paying 3½ mace. No ports but Tientsin and Shanghai seem to export "jute."

2. "China Grass," "Rhea," or "Raw Hemp," *i.e.*, the raw fibre roughly stripped from the stem in "ribbons." An export from Hankow; pays an *ad valorem* rate of 5 per cent.

3. "Hemp Skin," *Ma-p'i*. An export from Amoy; pays 5 per cent. *ad valorem*. I cannot say what kind of hemp this is, nor what is the plant from which it is derived, and information on this point is very desirable.

4. "Pine-apple Hemp." The tariff for "hemp," *i.e.*, 3½ mace, is levied.

5. *Export from the different Ports.*—I roughly summarise, with running notes, from the Customs Returns for 1889 :—

Tientsin.—Export for that year of 13,619 piculs of "jute." I consider this to be really Abutilon hemp; Chihli is the province of production.

Ichang.—1,506 piculs of "hemp" exported in 1889. This is mainly Abutilon hemp, though some "Indian jute" may be included. Produced in Szechwan. Always called *Ch'ing Ma* on the Ichang Customs documents.

Hankow.—105,278 piculs of "hemp" exported in 1889. No distinction is made in the return between Abutilon hemp, Russian hemp (if any), jute, or Rhea fibre. A certain portion is unquestionably Abutilon hemp from Szechwan and Hupeh, and the larger part is "Rhea fibre" from Hupeh.

Kiukiang.—25,704 piculs exported in 1889; all called "hemp." This is probably all Rhea fibre from Hupeh and Kiangsi.

Wuhu.—290 piculs of "hemp" exported in 1889. Produced in Anhwei, and perhaps Rhea fibre.

Chinkiang.—1,059 piculs "hemp." It is doubtful what this really is.

Shanghai.—390 piculs "hemp," and 21 piculs "jute," of local production. What are they?

Ningpo.—264 piculs "hemp skin."

Foochow.—52 piculs "hemp."

Takow.—1,374 piculs "hemp" (this is "pine-apple hemp"), and 541 piculs "hemp skin."

Amoy.—6,215 piculs "hemp skin."

Swatow.—10,916 piculs "hemp skin."

Kowloon.—913 piculs "hemp" and 1,643 piculs "hemp skin."

Lappa.—2,355 piculs "hemp," and 1,720 piculs "hemp skin."

Kiungchow.—983 piculs "hemp." This is "pine-apple hemp," and is produced in the island of Hainan.

From the southern ports, it will be noticed, there is a larger export of "hemp skin," a very ill-sounding name. It is, probably, an undressed hemp, and may be the product of the common or Russian hemp plant; but the point ought to be elucidated, and a better English name substituted.

C.—*Points requiring elucidation.*

1. What is the export from each port of the different articles properly classified as being *Russian Hemp*, *Abutilon Hemp*, *true Jute*, *Rhea fibre*, *Pine-apple Hemp*, &c.?
2. What is "hemp skin"?
3. From what plant is the "Savage Cloth" of Formosa made, and what is the process of manufacture, &c.?
4. Grasscloth ought to be distinguished according as it is made from Rhea fibre, Pine-apple hemp, &c.
5. Are there any other plants than those mentioned which yield textile fabrics in China of any commercial importance?
6. Specimens of the "jute plant," especially in fruit, are required, as the species *Corchorus capsularis*, L., is not settled beyond the shadow of a doubt.
7. Particulars regarding the place of production, the manner of cultivation, and preparation, are wanted, &c., &c.

(Signed) AUGUSTINE HENRY.

London, October 15, 1890.

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, March 25, 1891.

WITH reference to your letter of the 26th of November last, I am directed by the Marquis of Salisbury to transmit to you a copy of a despatch from the Acting British Consul at Wênchow, including a report on Rhea cultivation in China.

A copy of a further despatch from Mr. Hosie transmitting a report on another textile plant, is also enclosed.

Mr. Hosie states that a case of specimens illustrative of his reports will be forwarded direct to Kew Gardens. * * * *

I am, &c.
(Signed) T. H. SANDERSON.

W. T. Thiselton Dyer, Esq., C.M.G.,
Kew Gardens.

[Enclosure.]

ACTING CONSUL HOSIE to the MARQUIS OF SALISBURY.

MY LORD, Wênchow, January 26, 1891.

IN connexion with my preceding despatch of this date, I have the honour to enclose a brief Report on another textile plant cultivated in this neighbourhood. It is to all appearances a species of *Abutilon* [since determined as *Corchorus capsularis*, L.]; but its lanceolate and glabrous leaves, its rugose awnless capsules, and its general appearance and size distinguish it from any *Abutilon* that I am acquainted with, in the Flora of China or of India.

I was reserving these brief notes until I had collected more detailed information; but as I am under orders to proceed to Chefoo, and as it will therefore be impossible for me to conduct further experiments with the plant during the present year, I venture to forward the Report, brief as it is, in the hope that it may be of some interest to the Director of Kew Gardens.

* * * * *

I have, &c.
(Signed) ALEXANDER HOSIE,
Acting Consul.

The Marquis of Salisbury, K.G.

REPORT on the CULTIVATION, at WÊNCHOW, of a FIBRE PLANT, and on the EXTRACTION and USES of its FIBRE.

Cultivation.

The seeds of this fibre plant, called *Lu Ma* in the neighbourhood of Wênchow, are sown in May. The ground having been made into beds in the usual Chinese fashion, shallow openings from nine inches to a foot apart are made in the surface by hand or hoe. Into each opening a pinch of seeds is dropped, and covered with a little vegetable ashes. When the young plants appear they are manured once with liquid manure, and when about an inch high they are weeded out, not more than three plants being allowed to grow together. When a foot high they are again manured with liquid manure. In July, small yellow flowers appear on the stems, which have meantime grown to a height of five or six feet, and quickly dropping their petals give place to clusters of seed capsules, usually three in number and firmly attached to the stems. The latter continue growing and flowering until the end of August, blossoms showing on the tips when the seed capsules beneath are fully developed. By this time the stems have attained a height of 9 to 12 feet, with a circumference at the base of from 2 to 3 inches, and with branches commencing some 3 feet from the ground. The stems, which are green and supple throughout, are harvested before the seed capsules have changed colour, that is, before green has given place to brown.

Harvesting.

They are plucked up by the roots, the adhering soil being removed by beating against the nearest stone, and where I saw the stems harvested, the roots were thoroughly washed in a pond close to the field.

Decortication.

Two men are required to remove the peel. One takes hold of the plant by its branches, the other seizes the stem below the first branch between two rounded pieces of wood about a foot long and from three to four inches in circumference, tapering somewhat towards the end so as to provide a firmer grip for the hands. The first workman pulls the stem through the two pieces of wood which crush it, separate the peel from the central woody matter, and remove the root. The plant is then reversed and the branches are pulled through the wooden handles and crushed, and the leaves and seed capsules dislodged. The woody matter that has not meantime fallen to the ground is brushed away by hand, and the peel of stem and branches is ready to be made into bundles for market.

Uses.

Such is the treatment which the plant receives when the fibrous peel is to be made into cordage; but, when it is to be manufactured into sacking or coarse cloth, the plants, when harvested, are steeped for a day in cold water, and, when manipulated as above described, much of the outer cuticle is removed in the process, and when bleached, a whiter fibre is obtained.

The plant grows luxuriantly on the plains; but I have also seen it cultivated at an altitude of over 1,300 feet.

* * * * * *

(Signed) ALEX. HOSIE,
Acting Consul.

H. B. M. Consulate, Wenchow,
January 26, 1891.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

SIR, Royal Gardens, Kew, May 5, 1891.

I AM desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 25th March enclosing copies of despatches, in original, received from the Acting British Consul at Wenchow, on certain fibre plants.

2. The specimens illustrative of Mr. Hosie's reports have since been received at Kew, and they are all of an interesting character. The specimens referred by Mr. Hosie "to a species of Abutilon" and "called in the neighbourhood of Wenchow *Lu Ma*," have proved to

belong to *Corchorus capsularis*, L., the plant yielding Indian jute. It would therefore be better to call this fibre simply "China jute." There is a fibre yielded by a species of Abutilon, but this appears to come from Northern China. * * * *

I have, &c.
(Signed) D. MORRIS.

Sir Villiers Lister, K.C.M.G.,
Foreign Office, S.W.

Acting Consul HOSIE to FOREIGN OFFICE.

MY LORD, Chefoo, September 5, 1891.

WITH reference to the enclosure in your Lordship's despatch to me of June 5th last, wherein the Assistant Director of the Royal Gardens, Kew, mentions a plant grown in North China which yields a fibre known in the London market as China jute, I have the honour to forward herewith a brief report on the cultivation of the plant in question, and on the method of extracting the fibre.

I am sending direct to Kew, by parcel post, dried flowering and fruiting specimens of the plant, a packet of seed, and a sample of the fibre.

The only other plant cultivated in this neighbourhood for its fibre is *Cannabis sativa* or Russian hemp.

I have, &c.
(Signed) A. HOSIE,
Acting Consul.

The Marquis of Salisbury, K.G.,
Foreign Office.

[Enclosure.]

REPORT on the CULTIVATION of a FIBRE-YIELDING PLANT at CHEFOO.

This plant, known in the north of China as *Ch'ing Ma*, or more briefly *Ch'ing*, yields the fibre, also called *Ch'ing*, which appears as "jute" in the export returns of the Imperial Maritime Customs. It is an annual. The seeds are sown towards the middle of April in land that has previously been well worked and manured, several seeds being sown together at intervals of about a foot apart, and not more than an inch under the surface. Unless, however, the soil is rich, only one of the seedlings is allowed to mature. In years of normal rainfall the stems, which are branchless with alternate large smooth serrated ovate acuminate green leaves with long leaf-stalks, attain a height of eight to ten feet. They are green and supple throughout, with a circumference at the base of from 1½ to 3½ inches. In July and August they bear numbers of yellow five-petalled flowers on stalks, which spring from the axils of the leaf-stalks. These quickly fall, and are succeeded by seed capsules of comparatively large size, grooved, and semi-spherical in shape. Each capsule is made up of a number (11–15) of cells, with awns at the upper ends curving down, and into the centre of the capsule. Each cell contains three seeds, which, white at first, assume when ripe a dark brown colour. The latter, which have the appearance of each having had a notch made in it, are released at the proper season by the opening of the outer and upper walls of the cells. Towards the end of August the plants have attained maturity. They are then cut down by knife near the root, and the leaves and tips are lopped off. The stems are made up into bundles tied loosely at the tip end, and placed upright in standing water, so that only the lower halves are submerged. The root halves being more matured than the upper require more retting, and for this reason they undergo two days' preliminary sleeping. After the lapse of two days the bundles are laid on their sides in the water, and covered with sufficient earth to sink and bring them in contact with the bottom of the pond. In four or, at the most, five days the fibrous peel is loose enough to be easily removed by hand from the woody interior. The fibre ribbons, which have now all but lost their green colour, are afterwards washed in clean cold water and spread out in the sun, and when dry they are of a good white colour, such of the external greenness as remains after the retting and washing disappearing in the process of drying.

These remarks apply to the plant as cultivated at Chefoo, but I am informed that in other parts of this province and in the Mongolian hills the stems attain a much greater height and yield a longer fibre. The fibre exported from Tientsin, for example, much of which probably comes from Mongolia, is sometimes found to be as much as fifteen feet in length, whereas the plant itself does not attain that height in the light sandy soil near Chefoo.

The table annexed to this Report* gives the climatic conditions under which the plant is cultivated here.

(Signed) ALEX. HOSIE,
Acting Consul.

H. B. M. Consulate, Chefoo,
September 5, 1891.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

Royal Gardens, Kew,
November 23, 1891.

SIR,

I AM desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 21st ultimo, forwarding a copy of a despatch and report by Mr. Hosie, Acting Consul at Chefoo, on the subject of a fibrous species of *Abutilon* yielding Chinese jute.

2. The specimens mentioned by Mr. Hosie and sent direct to this establishment have now been received. These specimens were admirably prepared, and taken with the report they definitely settle the question raised in my letter of the 5th May last in regard to the origin of Chinese jute from Northern China. The plant yielding it is *Abutilon Avicennæ*, Gærtn., a widely diffused species in Eastern Asia.

3. Mr. Thiselton Dyer would express the hope that Mr. Hosie may be thanked for the very intelligent manner in which he has prosecuted his inquiries in this matter, and for the valuable assistance he has afforded to this establishment.

I have, &c.
(Signed) D. MORRIS.

Sir T. H. Sanderson, K.C.M.G.,
Foreign Office, S.W.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

July 17, 1891.

SIR,

I AM directed by Mr. Thiselton Dyer to inform you that he has read with interest the Report on the Trade of Kiungchow for the year 1890, by Acting Consul Parker [F. O. Annual Series, 1890, No. 898], and the numerous references contained in it to the plants and plant-products noted by him in the journey inland up the Poh Chung river.

---

* Not reproduced.

2. Mr. Parker states on page 9 that "another peculiarity of this " region is the ubiquitousness of the dwarf *Pandanus*, probably the " same as the *P. odoratissimus* of Fiji, the fibre of which here, as there, " is used in the manufacture of 'grass-cloth,' and is usually known to " foreign trade here as 'hemp.'" In the marginal note this is described as "cloth from the wild pine-apple."

3. As the various plants yielding what is locally known as "hemp" in different parts of China are now in course of being investigated at Kew, Mr. Thiselton Dyer would be glad to receive dried specimens of leaves of the *Pandanus* described by Mr. Parker, and also specimens of the fibre as it usually appears in trade at Kiungchow. The latter would be placed for reference in the Museum of Economic Botany attached to this establishment.

I have, &c.
(Signed) D. MORRIS.

Sir Villiers Lister, K.C.M.G.,
Foreign Office, S.W.

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, November 4, 1891.

WITH reference to the letter from this Department on the 23rd of July last, I am directed by the Marquis of Salisbury to transmit a Memorandum drawn up by Mr. Parker, Her Majesty's Consul at Kiungchow, showing that the hemp exported from the above-mentioned place is made from the fibre of the pine-apple, and not of the *Pandanus*.

The parcel of specimens alluded to in Mr. Parker's Memorandum has not yet arrived, but will be forwarded directly it is received.

I am, &c.
(Signed) T. H. SANDERSON.

W. T. Thiselton Dyer, Esq.,
Kew Gardens.

[*Enclosure.*]

REPORT BY MR. CONSUL PARKER, KIUNGCHOW.

The inquiry instituted by the Kew authorities has led to the discovery that the finer kinds of "hemp" which are exported hence are the fibre of the pine-apple, and not of the *Pandanus*.

Mr. Stuhlmann, in his Customs Report for 1877, does, indeed, mention this "pine-apple fibre," other two Commissioners refer to it as "hemp." Mr. Commissioner Neumann, in his Report for 1889, says:—"What is " exported under the name of hemp is the fibre of the pine-apple plant " (*Pandanus*); it comes principally from the Lei-chou peninsula, and " realises as much as $40 to $140 the picul" [1*s*. to 3*s*. a pound].

From the appearance of the ubiquitous *Pandanus*, I should suppose it to be the same plant as the *Pandanus* of Fiji, which colony I have recently visited. I now find, however, that the Fijians only make mats, not clothing, out of the *P. odoratissimus;* and that the *Pandanus* of Hoihow is useless except for hedgerows and fuel. It is said that, somewhere inland, mats are made of it here, and that its root is used in the Pharmacopœia as a febrifuge. Parcel No. 4 contains a few leaves of this plant, and the tin box contains its fruit, which seems to mature from April to September at least, if not all through the year.

Parcel No. 2 contains leaves of the plant from which the so-called "hemp" is manufactured. These come from *Mun-shio* or *Wên-ch'ang*, a district a few days' journey to the east, which district appears to be the only one upon this island where pine-apple "hemp" and the cloth from it are manufactured.

Parcel No. 1 contains the leaves of a pine-apple plant, *grown for the fruit only*, obtained at a village five miles to the west of Hoihow: natives of *Mun-shio* in my service assert that this is the same as the pine-apple of *Mun-shio*, the fruit of which, though eaten, is of secondary consideration there.

Parcel No. 3 contains imperfect leaves of the pine-apple plant of the *Lei-chow* peninsula, opposite Hoihow, from which the natives there are *said* to manufacture a "grass-cloth," which is *supposed* to be brought over here in junks for export hence.

Parcel No. 5 contains a leaf of the plant (no whereabouts given) from which the Customs here were convinced the local "grass-cloth" was made: they supposed it was the *Pandanus*, until I proved to them that it was not. The *Pandanus* has a prickly seam down the centre of the leaf.

The leaf of the pine-apple is first scraped with a bamboo knife; it is then torn apart, and washed in cold water in which rice has been washed. It is next dried in the sun and aired at night; after which the skeins are combed, and the ends of each thread are joined, by a twist of the fingers, to each other. The material is then sized with rice-gruel, drawn through bamboo tubes, and cleaned of its knots, joinings, and protuberances.

Parcels Nos. 5A, 6, 7, 8, 9, and 10 represent the pure pine-apple fibre in its various stages. Nos. 6, 7, 8, 9 appear to be mere qualities of No. 5A, each of which is capable of becoming No. 10 if sufficient labour is given to it.

Parcel No. 11 contains specimens, with prices, of pure pine-apple "grass-cloth," presumably corresponding in quality to Nos. 6, 7, 8, or 9.

Parcel No. 12 contains a mixed web of ordinary cotton and pine-apple fibre interwoven.

Parcel No. 13 contains specimens of hemp and hemped cloth from *Mun-shio* by way of contrast.

(Signed) E. H. PARKER,
Consul.

Kiungchow, December 22, 1891.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

SIR, Royal Gardens, Kew, November 26, 1891.

I AM desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 4th instant forwarding a memorandum drawn up by Mr. Parker, Her Majesty's Consul at Kiungchow, on the subject of pine-apple fibre prepared at the above-mentioned place.

The parcel of specimens alluded to in Mr. Parker's memorandum having arrived at Kew, it has been carefully examined in accordance with the information furnished in this and the previous correspondence.

There can be no doubt that the leaves sent by Mr. Parker are those of the pine-apple plant (*Ananas sativus*, Baker), and the fibre corresponds with that usually yielded by members of the pine-apple family.

The Pandanus represented by leaves and one fruit, is, as Mr. Parker supposed, *Pandanus odoratissimus*, a native of tropical Asia. The fibre prepared from the leaves of the Pandanus is usually of poor quality, and it could not be mistaken for that of the pine-apple. The specimens forwarded by Mr. Parker were carefully put up and labelled, and, taken with his memorandum, they may be considered to have definitely settled the point at issue. Mr. Thiselton Dyer would venture to express the hope that the Secretary of State will communicate the thanks of this establishment to Mr. Parker for the very intelligent manner in which he has assisted in this inquiry.

I have, &c.
(Signed) D. Morris.

CCXIX.—IPOH POISON OF THE MALAY PENINSULA.

(*Antiaris toxicaria*, Lesch.)

In the *Kew Bulletin* for February of the present year, some account was given of the investigations which at different periods during the past 10 years have been carried on through Kew on the Ipoh poison of the Malay Archipelago. The results are summed up in the following paragraph :—

"The facts as they stand present a rather curious puzzle. There can be no doubt that in Java the Upas tree furnishes a very effective arrow poison. It may be inferred that its use originated in Java and some of the other Malay islands. Finding the same tree on the mainland the Malays used its juice. But they mus have long since discovered that it is innocuous. According to Griffith they remedy the defect with arsenic. If this is really done it must be when the arrows are prepared; for two authentic specimens of Ipoh poison from the Malay Peninsula were absolutely inert, and contained none of the poisonous principle Antiarin."

To these conclusions, which appeared justified by the facts which were received at the time, the Government of Perak is unable to assent, and the Curator of the Perak Government Museum has sent to Kew an extremely interesting report, and an admirable series of specimens, which will enable the whole subject to be re-investigated.

Mr. Wray's report is now printed with his accompanying letter in advance of the results of the examination of the presumed poisonous fluids, which has been again kindly undertaken by Dr. Sidney Ringer, F.R.S., Professor of Clinical Medicine, University College, London.

Mr. Leonard Wray, Junior, Curator of the Perak Government Museum, to Royal Gardens, Kew,

Perak Museum, Larut, Perak, Straits Settlements.
(Received 8 October 1891.)

Dear Sir,

I was much interested in your paper in the *Kew Bulletin* on Ipoh, and believing, from what I have seen and heard, that, from causes which it is hard to understand, the specimens and information on which you based your conclusions were unreliable, I obtained the permission of the British Resident of Perak to investigate the subject, and I now enclose a paper containing the results of my inquiries for insertion, if you think it of sufficient importance, in the *Kew Bulletin.*

I have also sent a box containing a number of specimens illustrating this paper, together with a few others which you may like to have for your museum, and I now enclose a list of the contents of this box.

If you would kindly examine the botanical specimens I send, and add a few remarks on them, it would make the paper much more valuable. I have very likely already collected specimens of the three plants from which *ipoh aker* is obtained, and you may be able to find them in the Kew Herbarium, as Dr. King sends duplicates of my plants to you.

If you could also get someone to try a few experiments with the poisons I send, both as to their effects on animals and the nature of their poisonous principles, the whole question would be finally settled.

As the poisons are all mixed with spirits there is no fear of their becoming inert, and I can guarantee their being the actual poisons used by the aborigines. They will simply require evaporation on a water bath to be in a fit state, with the addition of a known quantity of water for injection. If a fatal result is required about one grain of the dried poisons should be used.

I will write again about the live plants I am sending you, and am

Yours truly

(Signed) L. Wray, Junior.

W. T. Thiselton Dyer, Esq., C.M.G., F.R.S.,
Director of the Royal Gardens, Kew.

P.S.—I am much obliged to you for the determinations of the Musci and Hepaticæ which I received by last mail.

IPOH AND OTHER ARROW-POISONS USED BY THE ABORIGINES OF PERAK, IN THE MALAY PENINSULA.

There are two tribes of aborigines in Perak who use arrow-poison, viz., the Semangs and the Sakais. The former people, who live in the north of Perak, use both blowpipes and bows and arrows; while the latter, who live in the southern part of the State, use blowpipes only.

I recently visited Ulu Selama, where some of the Semangs live, and was taken by them to a place called Kuala Jah, at, I should estimate, 500 feet elevation, where I was shown, growing in the virgin forest, within 100 yards of one another, two large Ipoh trees. The larger was about 5 feet in diameter at 5 feet from the ground, and had a trunk full 100 feet in height to the first branch. It had been tapped many times, the bark being deeply scored up to a height of 25 feet from the ground; the smaller tree was also scored all over. The bark externally is white, and internally orange-brown, and is very thick and fibrous. On cutting fresh scores into the bark, the dirty whitey-brown sap ran very sparingly out, and was conducted down palm leaves stuck on to the trunk of the tree with clay, into bamboos. The scores are cut slanting alternately right and left, like what is known as herring-bone stitching, with the lower ends of the scores pointing inwards. At the bottom of each series of scores is put a leaf, fastened to the bark with clay, to lead the sap which trickles down into a bamboo. We only succeeded in getting about 3 ozs. of sap the first day; but two days afterwards, by erecting a scaffolding around the tree and extending the scores up the trunk we got about one pint. Three ounces of sap, the Semangs said, was enough to poison 100 blowpipe arrows.

The sap having been collected from the trees, a spatula-shaped piece of wood was taken and heated over a clear wood fire, and a small quantity of the sap poured on it and spread out with another but smaller wooden spatula, and held over the fire till nearly dry, and the process repeated till all the sap was evaporated. There remained on the spatula a dark brown gummy substance, on which the points of the arrows were rubbed three times, being dried over the fire between each application of the poison. This simple process completed the preparation of the poison; but as there are sometimes other things mixed with the Ipoh, I shall return to this part of the subject again.

The sap, which I found to be bitter and biting in taste and decidedly acid to test paper, on exposure to the air quickly darkens to a brown colour, and it yields when dried on a water-bath 29 per cent. of solid Ipoh. This substance, if put thinly on a slip of glass and examined by a microscope, is seen to contain numerous crystals of antiarin.

A portion of the sap was mixed while fresh with its bulk of spirits of wine, to prevent its decomposition, and corked up, samples of which are forwarded to the Director of the Royal Gardens, Kew, with this paper, marked Nos. 12 and 13. I also obtained leaves from the larger of the two trees, which are marked No. 6, and the dried poison on the spatula, marked No. 23, as well as leaves of a young Ipoh tree, marked No. 5. These latter are decidedly pubescent, while those from the large tree are glabrous. There were neither fruit nor flowers on the trees, but I sent to Kew fruiting specimens of the Ipoh in 1883, which were pronounced by the present Director of the Gardens to be identical with the Javan specimens of *Antiaris toxicaria* in the Kew Herbarium. The trunk of the tree from which these specimens were obtained was also much scored, showing that its sap had been collected by the aborigines. Specimens of this tree were also communicated to Dr. G. King at the Botanical Gardens, Calcutta, who identified it as *A. innoxia.*

It may be mentioned in reference to the two kinds of Upas distinguished by Blume as *Arbor toxicaria femina* and *mas*, that the latter word, which is Malay, means "gold" and not "male" as inferred in the former paper. It is so called from the golden colour of the inner bark. In the innocuous variety, I was informed by the Semangs, the inner bark is blackish coloured, and it is by the colour of the inner bark that they distinguish the poisonous from the non-poisonous trees.

From some of the sap collected in Ulu Selama, I have separated the poisonous principle antiarin, a small tube of which containing 4·6 grains, being the amount obtained from one fluid ounce of the sap, accompanies the other specimens (No. 21).

The process I employed to isolate the alkaloid was that quoted from Watt's Dictionary of Chemistry in the paper on Ipoh in the *Kew Bulletin*, and is briefly as follows:—

Evaporate to dryness on a water bath the mixed sap and spirits of wine, add water, heat, filter, wash filter with hot water, evaporate filtrate and washings to a syrup and allow the antiarin to crystallize; purify by re-crystallization.

The antiarin appears as minute diamond shaped crystals, many of which have the obtuse angles replaced.

The so called antiar-resin, when separated from the fresh sap, is nearly white and much resembles caoutchouc, though it doubtless assumes a resinous appearance on long exposure to the air. One fluid ounce of the sap yielded 17·5 grains of antiar-resin, a small sample of which is marked No. 22.

By Watt's method of separation just detailed it is only possible to isolate a portion of the antiarin contained in the fresh sap, owing to the large amount of extractive matter present in the solution, and I found it necessary to modify the process by precipitating the extractive matter by acetate of lead, filtering, precipitating any excess of lead with sulphuric acid, neutralising the free acid with carbonate of lime, filtering and evaporating the filtrate (which should be colourless) on a water bath till the antiarin crystallizes out. Then freeing the crystalline mass from any sulphate of lime which may be present by dissolving it in spirits of wine or ether and re-crystallizing the now pure antiarin.

One fluid ounce of the Ipoh sap I found to yield, when so treated, 10·85 grains of antiarin, or 2·482 per cent. The dried Ipoh poison, of which the sap contains 29 per cent., therefore has 8·561 per cent. of antiarin in it, separable by the above process.

With the imperfect laboratory appliances at my disposal these results cannot be considered as more than estimates of the total amount of poison present; and unfortunately I have no analysis of Upas with which to compare them.

As the result of weighing coated darts and washing off the poison and re-weighing, the amount of Ipoh on them may be taken to be rather less than one grain, and by the estimate above given this weight of the dried poison would only contain ·086 of a grain of the alkaloid; which, however is sufficient to produce a fatal result when introduced into the circulation of an animal weighing as much as 20 pounds.

On the afternoon of the day on which the sap was collected I tried the following experiments with it on two fowls.

Experiment 1.

June 9, 1891.—Three minims of the fresh sap was injected hypodermically with a syringe, without drawing blood, into the leg of a fowl.

In three minutes the leg was affected and the bird was rather lame, but for half-an-hour remained otherwise quite well, eating freely and walking about. It then became rather dull and sluggish, and voided at very frequent intervals.

Twelve hours after the injection it was apparently not much the worse for the operation, but a large dark patch had formed where the injection had been made, covered with loose skin and surrounded by extensive inflammation, and radiating from it were several enlarged blood vessels.

Twenty hours after it was very lethargic.

Forty-two hours after the inflammation was subsiding, but the bird was still very dull, though I have no doubt of its ultimate recovery, but as I had to leave the place, could not continue observations on it.

Experiment 2.

June 9, 1891.—A poisoned dart point, which had been prepared before me from the same sap, was stuck into the leg of a fowl and slight lameness and diarhœa came on, but no other symptoms.

A second arrow was stuck into the other leg after half an hour had elapsed, but hardly any effect followed.

Twelve hours afterwards dark patches surrounded the wounds, and there was extensive inflammation of the adjacent parts and considerable inflation of the sides and upper part of the body by air close under the skin.

Twenty hours after it was lethargic, but not so ill as would be expected by the local symptoms.

Forty-two hours after, still lethargic, but the inflammation subsiding and the skin round the wounds assuming a greenish hue. Further observation could not be made, but I think its recovery was certain.

In regard to these two experiments, the Semangs said that neither fowls nor argus pheasants are affected by the poison, and that as many as ten darts may be stuck into one of these birds without causing its death. It therefore became necessary to try an experiment on a susceptible animal, and a full grown cat was used for that purpose.

Experiment 3.

June 10th, 1891.

2.3 P.M. Dart similar to those used in experiment 2, stuck into the cat.

2.13 P.M. Diarrhœa and vomiting began.

2.20 P.M. Convulsed.

2.22 P.M. Dead.

As the poison used in this experiment was that collected and prepared in my presence the day before, the virulence of the Malayan *Antiaris toxicaria* is proved beyond the shadow of a doubt. The poison seems to be as rapid as the Javan Upas, 19 minutes only having elapsed between inoculation and death, while the animal was quite disabled in 10 minutes time.

These experiments also prove the comparative immunity from the effects of the Ipoh poison enjoyed by fowls, which is a matter of considerable scientific interest.

The previous experiments which have been made on samples of Ipoh sent from the Malayan Peninsula, as detailed in the February number of the *Kew Bulletin*, can only be explained in two ways; either the sap brought in by the collectors was the sap of some other non-poisonous tree, or the sap underwent decomposition with consequent destruction of the antiarin contained it it, before reaching the hands of the experimenters in England.

There is no doubt that the material collected in 1881 by Sir Hugh Low, the then Resident of Perak, was quite authentic, as its poisonous properties were tried on some dogs here before it was transmitted to Kew; but the information and material supplied to Mr. D. Hervey was evidently not reliable, for the sap of *Antiaris* is poisonous *per se* as every aboriginal knows, and there is no such thing as "sap of *Ipoh aker*," in the sense in which the expression is used, that poison being an extract prepared from the bark of the plant, as I shall afterwards explain in detail. This extract, had it been sent, would have been very unlikely to decompose, as the Sakais keep it for years and say it does not lose its virulence.

What Griffith says about the poisonous properties of the Ipoh being derived from admixture of arsenic, was information probably derived from the Malays, for the aborigines are quite ignorant of that poison, and as Professor Ringer points out, the action of arsenic is very different from that of Ipoh, besides which animals killed with arsenic would be quite unfit for food.

I may here observe that it is the aborigines alone who use poisoned weapons in the Peninsula. The Malays put arsenic on their krises and spears, but it is employed solely with the view of bringing out the damaskeening of the blades and not as a poison.

I have had one opportunity of noticing the effects of Ipoh poison on a human being. It occurred while I was descending a river in Upper Perak in 1889, and I made the following note at the time. "While "unloading and carrying the baggage over the rocks, a poisoned blow- "pipe dart fell out of a quiver and stuck into the upper part of one of "the men's feet. It was at once pulled out and a Semang squeezed the "wound to get out as much blood as possible, then tied a tight ligature "round his leg and put lime juice on to the wound. The man com- "plained of great pain in the foot, cramps in the stomach and vomited, "but these symptoms soon passed off. The point only went into the "foot about one-third of an inch, and the dart was instantly pulled out. "The Semangs said that had it gone deep into a fleshy part of the body "it would have caused death."

The blowpipe darts are only about one-twentieth of an inch in diameter, are sharpened to a fine taper point, and are poisoned for a length of nearly one inch and a half, the poison being put on very sparingly near the point, so as not to interfere with their penetrative power. A slight notch is often cut in the dart just below the poisoned tip, so that it may break off into the wound.

As previously stated, besides the blowpipe darts, the Semangs use bows with poisoned arrows. These arrows have detachable fore-shafts, with either barbed iron or hard wooden heads. These heads are about 2 inches long by $\frac{3}{4}$ inch broad, and are thickly coated, except near the point, with poison. I have not seen the effects of one of these arrows on an animal, but the Semangs, amongst whom I lived on one occasion for about three months, say that they are able to kill pig, sambur deer, wild oxen, and even rhinoceros with them, and as I have seen bones of these animals at their camps, there appears to be no reason to doubt the truth of the statement. It was asserted that a deer would drop in from 30 to 40 yards after being struck by an arrow. The rapidity of the action of the poison depending on the vascularity of the portion of the body pierced by the arrow.

I may here mention, as the subject has been referred to in the previous paper, that the bark of the *Antiaris* is used by both the Semangs and Sakais as bark cloth. It is prepared as follows :—A young tree is felled and cut into pieces of suitable length. With a knife the outer portion of the bark is shaved off and the inner bark is beaten with bat-shaped pieces of wood until it will slip off from the stem. The bark is then put into running water, in which it is allowed to remain for the space of one month to free it of the poison ; then it is beaten with wooden bats, on one face of which furrows have been cut at right angles to each other, to produce a grain on the finished cloth.

As stated above, the Semangs sometimes mix other poisons with the Ipoh. The plants from which these are derived are known to the Malays as *likir* and *gadong*. In both cases it is the expressed juice of the tubers that is employed. The *likir* is an Aroid belonging to the genus *Amorphophallus*, and the *gadong* is a thorny climbing yam belonging to the order *Dioscoreaceæ*. Botanical specimens of both these plants have been sent to the Calcutta Botanical Gardens, but identifications have not yet been received. A flowering specimen of the *gadong* I send with this paper. It is probable that the specimens of *likir* have been transmitted to Kew by Dr. King, in which case they will be found numbered 3327.

The tubers are rasped up fine with a knife, and the soft mass put into a piece of cloth, which is then forcibly pulled through two pieces of stick tied firmly together a short distance apart, so that the juice, which is very acrid, is expressed without coming in contact with the hands. The juice of the *likir* and *gadong* tubers so obtained is mixed with the Ipoh sap, and the mixture dried on a wooden spatula over a fire, and the arrows poisoned in the way that has already been described.

The tubers of both these plants, which contain starch in large quantities, are cut up into thin slices and suspended in a basket in running water and allowed to steep until the poison contained in them has been dissolved out. They are then cooked and eaten by the aborigines, and also occasionally by the Malays.

The acrid juices of these plants are said not to be fatal by themselves, and the part they play when mixed with the arrow poison is to cause local irritation, which hinders wounded animals from escaping before the antiarin has time to act; but all the Semangs and Sakais I have asked have said that the pure Ipoh is more deadly than the mixture.

A bottle of *gadong* juice and another of *likir* juice mixed with spirits of wine are included in the collection accompanying this paper.

The juice of the tubers of the *gadong* is decidedly acid when fresh. It smells somewhat like raw potatoes, and is bitter and astringent, producing a stinging sensation on the tongue, and a very unpleasant dry feeling in the mouth, which persists for a considerable time. The acidulated juice yields a yellowish-brown precipitate to a solution of iodine in iodide of potassium. The precipitate re-dissolved in sulphureous acid and evaporated yields long branching needle-like crystals. The juice mixed with spirits, filtered and evaporated to dryness and re-dissolved in dilute sulphuric acid filtered and evaporated again, also yields long branching crystals, which have an astringent taste like the juice, and are possibly the poisonous principle.

The freshly expressed juice of the *likir* tubers is faintly acid to test paper. It smells somewhat like beetroot, and is acrid, and causes irritation if it is applied to the skin. It appears not to contain any alkaloid, as it affords no precipitate when a solution of iodine in iodide of potassium is added to the filtered and acidulated juice, nor when the juice is just rendered alkaline by potash. When distilled, the distilate smells like the juice, and is slightly opalescent, but it does not cause irritation when applied to the skin, or even to a wound. It tastes the same as it smells, and does not injuriously affect the tongue.

To complete this injuiry into the sources of the arrow-poisons of the aborigines, I visited the district of Batang Padang, to ascertain how the Sakais prepare their poison. As previously mentioned they only use it on their blowpipe darts, as bows and arrows are not employed by them.

I visited two Ipoh trees, both of which were deeply scored like those in Selama. The scoring of the bark was not, however, so regular as with the Semangs, and I saw no sign of the herring-bone method. The usual plan was to cut detached V-shaped incisions, and the method of collecting the sap differs also from that already described.

Several pieces of bamboo are taken, and to each is fixed a piece of wood, which is ingeniously cut so that when its chisel-shaped upper end is applied to the bark of the tree below a score the sap flows, first down its upper surface till it meets a cut channel which conducts it round to the under surface, and so into the bamboo receptacle.

The sap being collected, two wooden spatulas are prepared and a piece of large bamboo split in half so as to form a small trough and the sap poured into it. The larger spatula is heated over a fire and the sap ladled out of the bamboo and spread on its heated surface by means of the smaller spatula and dried by being held with the uncoated side over the fire; it is then reversed and sap spread on its upper or uncoated side, and when that is in its turn nearly dry again reversed, and a fresh supply of sap put on to the surface first coated. This is repeated until all the sap has been inspissated.

The darts are coated in the manner before mentioned, and when the poison is very hard and dry and will not soften by being heated, a few drops of water are put on to the spatula and mixed by means of a smaller spatula, with the poison until it acquires the right consistency to apply to the points of the darts.

The Sakai and Semang methods of collecting and preparing the poison are really the same, only differing in details. The Sakais, however, do not mix *likir* juice with the *ipoh* and the way they mix the *gadong* juice with it is not the same as that employed by the Semangs. For this purpose the Ipoh sap is prepared as just described and a piece of the *gadong* tuber is peeled and sliced up fine and placed in a joint of a bamboo, and ground up with water by means of a wooden pestle. The fluid is then poured off and fresh water added and the process repeated. The fluid is then boiled and filtered through leaves in which some fine scrapings of bamboo are put. It is then evaporated in an open vessel over a fire to the consistency of a thick syrup and mixed with the *ipoh* in the proportion of three parts of *ipoh* to one of *gadong*.

The Sakais living in the plains employ the *Antiaris* poison as a rule, as the plants from which it is prepared are low country forms; but the Sakais of the hills use a poison prepared from three hill plants known as *ipoh aker*, or root Ipoh, in contradistinction to the antiaris or *ipoh kayu* (tree *ipoh*). These plants are called *ipoh aker*, *prual* and *lampong*.

Ipoh aker is a large climbing *Strychnos* with a stem often as much as 3 inches in diameter. It has dark green, glabrous, opposite, leaves, with three prominent longitudinal veins. The fruit is said to be large and round and to contain seeds about half inch in diameter and the flower is stated to be reddish. It grows on the hills and I have seen it at over 4,000 feet elevation. The specimens now procured were collected on Gunong Batu Puteh in Batang Padang. The portion of this plant from which the poison is extracted is the bark of the roots and lower part of the stem. It is often employed without admixture and is then prepared as follows:—

The bark, which is burnt sienna coloured, is scraped with knives from the roots; the scrapings are put into a pan with water and boiled, the water is poured off and filtered. Fresh water is added to the bark, which is again boiled for some minutes, and the water poured off a second time. The exhausted shavings of bark are then thrown away, and the filtered infusion, which is bright burnt sienna coloured, is reduced by boiling in an open pan to a syrup. It is then poured while hot into a bamboo, where it solidifies. It is applied to the darts in the manner already explained and is said to be more powerful than the *Antiaris*, but is rendered quicker in its action when mixed with the poison derived from the other two plants above mentioned.

Of these *Prual* is also a climber, growing on the hills. The largest stem I have seen was 1½ inch in diameter. It has opposite bright green entire leaves, but its flowers and fruit I have neither seen nor been able to get any description of. The young shoots contain a very fine strong, white, silky fibre. My specimens were also collected on Gunong Batu Puteh. The bark of the roots, which is rather pale yellow in colour, is the part of the plant which is employed in making the poison. This arrow poison is said not to be so strong as *Antiaris*, but to be quite capable of killing when used by itself.

The third part is called *lampong* and is also a climbing species of *Strychnos*. It has opposite, three veined leaves like *ipoh aker* only they are considerably smaller, and is stated to have similar fruit, but it grows lower down on the hills, my specimens being collected on the Cheroh hills. Like the two preceding plants, the bark of the roots, which is white, is the part from which the poison is extracted. It is said to be not so powerful as *prual*, but is often employed by itself.

In making the mixed poison six parts of scraped *ipoh aker* bark are taken to which is added one part of each of *prual* and *lampong* bark and the mixture is exhausted with boiling water, filtered and evaporated in the same way as has already been described, when simple *ipoh aker* is treated.

It was stated by the Sakais that *Antiaris* and *ipoh aker* are rarely if ever mixed with one another. The latter poison is said to retain its virulence, in the form of an extract, for years.

Specimens of the roots of these three plants and the extracts prepared from them, are forwarded with the other specimens, so that their toxic effects may be tried in England.

L. Wray, Junr., M.I.E.E., F.Z.S.,
Curator, Perak Government Museum
and State Geologist.

Thaipeng, August 30, 1891.

The following specimens were sent by Mr. Wray of the plants used in the preparation of arrow poison in Perak. They have been determined by Dr. Stapf, Assistant for India in the Herbarium of the Royal Gardens.

1. *Ipoh* leaves. Bottom branch of a large tree. Cheroh, Batang Padang.
   Antiaris toxicaria, Lesch.

2. *Lampong* leaves. Climber from Gunong Batu Puteh, Batang Padang.
   Strychnos Maingayi, Clarke (?).

3. *Ipoh Aker* leaves. Climber from Gunong Batu Puteh, Batang Padang.
   Strychnos sp., closely allied to *S. Maingayi*, and probably only a different state of it.

4. *Prual* leaves. Climber from Gunong Batu Puteh, Batang Padang.
   Rubiacea, possibly a *Lasianthus* or *Urophyllum*.

5. *Ipoh* leaves. Young tree. Ulu Selama.
   Antiaris toxicaria, Lesch.

6. *Ipoh* leaves. Upper branch of a large tree.
   Antiaris toxicaria, Lesch.

7. *Gadong.* Flowers pale green, leaves light green, climber with large tubers.

Dioscorea hirsuta, Bl. (D. dæmona, *Roxb.* var. *reticulata*, Hook. f. *MSS.* in Herb. Kew).

Leschenault mentions (Ann. d. Mus. d'hist. nat. xvi. 469) the use of the root of *Dioscorea triphylla* (D. hirsuta, *Bl.*) as one of the components of the Ipo, prepared by one of the Orang-daias from Borneo. There is also a note in the Kew Herbarium on a sheet with *Dioscorea* (Motley, 729, Bangaramassing, Borneo), as follows:—Dry hills, woods, &c., common. Malay *Gadung;* flowers green; the roots are eaten, but undergo an elaborate preparation being very poisonous in a fresh state.

Dr. Stapf notes that in 1880 the Conde de Ficalho (*Flora dos Lusiados*) has referred two of the plants mentioned in Camoens's poem to *Antiaris toxicaria* and *Strychnos Tiéuté.* This would involve a very early knowledge of the Ipo plants.

CCXX.—BOTANY OF GAMBIA DELIMITATION COMMISSION.

By an arrangement, signed at Paris, August 10th, 1889, concerning the delimitation of the English and French Possessions on the West Coast of Africa, the frontier line between Senegambia and the Colony of the Gambia was established.

The Commission for marking out the boundary left England at the end of 1890, and was absent about six months.

The Colonial Office was unable to make any arrangement for attaching a botanist to the expedition, but suggested that Kew might find a medical officer with the necessary qualifications. With the aid of Professor Bayley Balfour, F.R.S., Regius Keeper of the Royal Botanic Garden, Edinburgh, Dr. Brown Lester, a medical graduate of the University, was ultimately selected for the duty.

The Commission kept in the neighbourhood of the River Gambia, and Dr. Brown Lester made a collection fairly representative of its flora as far as the dryness of the season would permit. From a botanical point of view it does not exhibit any very great interest. But the specimens have been determined at Kew, and a list of the determinations, with Dr. Brown Lester's brief notes, is annexed. Taken together they afford a useful picture of the character and productions of the country traversed.

Clematis Thunbergii, *Steud.*—Creeping plant. Bakindic Kotu, north bank. At Bakindic Kotu the ground rises to about 50 feet above sea-level. Kous (African millet) and rice are cultivated in patches around the village. Bush around is dense, with small trees and long grass; patches here and there are seen of primeval forest. Mahogany trees (*Khaya senegalensis*) are plentiful, also trees mentioned at Jinnak. Everything dry and parched except at one or two swamps. A small quantity of ground-nuts are cultivated. Many "locust trees" are to be seen.

Ballé, on Swarakunda Creek, north bank. Soil dry and sandy, flat and swampy near the creek. Seen everywhere. Country at Ballé is still flat. Lots of palm trees of various kinds. Large mangrove swamps. Mangrove trees very high.

Argemone mexicana, *L.*—Plant 2 to 4 feet high. Grows near moist ground, *e.g.*, village well. An infusion of the leaves is used in coughs. Gungin village, south bank, two miles off the coast. Soil dry and sandy; at places swampy.

All the country about here is flat. There is a great deal of heavy bush, consisting of long grass and small trees, with quantities of small thickly-set palm trees. Between Brikhana and Gungur there is a large forest of bamboo, extending to 10 miles or so. Along the coast are large tall palms with fan-like leaves. There are many palms (? *Raphia vinifera*), yielding the palm-wine. Near the villages are groves of orange trees in a semi-wild state. They bear a very heavy crop of sweet large oranges.

The natives cultivate ground-nuts, kous, calabashes, and cotton to be made into "pagns." A small quantity of rubber is also got. Baobabs (*Adansonia digitata*) plentiful.

Mærua? tree, 50 feet high or so. Balanghar on the great bend of the Gambia River, north bank. Soil dry, sandy, and rocky (volcanic). Country here and there rocky, and hills of volcanic origin. Beside the river are mangrove swamps.

At Balanghar and around there are many swamps, and rice fields of great extent. Small volcanic hills and miles of long grass. Various kinds of palms. Country very dry and parched

No rain while on the north bank, except two hours thunderstorm, which was very local. Country consists of very dense bush with cleared patches near the villages. Very little water to be had except at places mentioned, and at the village wells.

Polygala arenaria, *Willd.*—Bakindic Kotu. Plant 1 to 1½ feet high.

Urena lobata, *L.*—Jinnak, north bank. Soil, dry and sandy. Country flat with swamps. Shrub 4 to 6 feet high Native name, *Bubo-Bubo*. Bark is used for ropes. Seen everywhere.

At Jinnak are many Baobab trees, silver cotton, *Strophanthus* creeper, cowhage (*Mucuna*), palms (yielding palm wine), palms with fan-like leaves, long grass 10 to 14 feet high, and miles of mangrove trees. Also large rice-fields.

Hibiscus cannabinus, *L.*—Jinnak, native name *Wild Saur*. An infusion of the leaves is used by the natives for coughs. Seen everywhere. Bark used for making ropes.—Bakindic Kotu. Plant 2 to 6 feet high.

Hibiscus physaloides, *G. & P.*—Plant 2 to 4 feet high. Collected in a wood, beside a grassy swamp, Ma Kuda, south bank. Soil, dark and moist. Country still flat with dense bush, little cultivation. Large patches of bamboo. Orange trees here and there. No water, except at village well.

Hibiscus, near **H. Grantii.**—Plant 4 to 6 feet high. Leaves, four times as large as specimen. Collected in a wood beside a grassy swamp, Ma Kuda. Soil dark and moist. Weather, warm and dry. Country flat, with large swamps.

Gossypium barbadense, *L.*—Torro, across Sware Kunda Creek, north bank. Soil dry and sandy. At Torro there are many swamps (mangrove), near the creek. Country same as before. Cotton plant 1 to 3 feet high, seen in all the fields all over the Gambia.

Waltheria americana, *L.*—Jinnak. Shrub 4 to 5 feet high. Seen everywhere.—Dramé Joku, north bank. Soil dry and sandy. Country very flat. Plant 6 feet high. Leaves are used as a poultice for bringing boils to a head. Seen everywhere; also at Ma Kuda, south bank. Plant 2 to 4 feet high. Collected in a wood beside a grassy swamp. Soil dark and moist.

Triumfetta rhomboidea, *Jacq.*

Acridocarpus sp.—Jarrol, Vintang Creek, south bank. Soil dry and sandy. Country flat. Plant springs from dry ground, in half a dozen stems only. Large swamps near the creek. Large mangrove trees on the creek. Large bush fires.—Also seen at Sanding, Vintang Creek, south bank. Soil dry and sandy. Country very flat and dry, except near creek. Many baobabs and patches of bamboos. Kous and cotton cultivated, also ground-nuts.

Icacina senegalensis, *A. Juss.*—N'Jaré, north bank. Soil dry and sandy. Country flat. Plant 1 to 3 feet high. Each branch springs out of the ground, and plant consists of two dozen or so of these shoots. Fruit collected on south bank.—Also at Sanding, Vintang Creek, south bank. Plant 1 to 2½ feet high. About 12 stems spring out of the soil together. Seen everywhere, but only in fruit.

Spondias microcarpa, *Rich.*—Ma Kuda, south bank. Soil dry and swampy in places. Country flat with large swamps. Tree 60 feet high. Large and spreading branches.

Moringa pterygosperma, *Gaertn.*—Never-die-tree. Tree 20 feet high. Always flowering. Government House Garden, Bathurst, Gambia. Soil dry and sandy.

Cnestis ferruginea, *DC.*—Gungur village. Tree 7 feet high. Trunk diameter 1 foot. The only specimen seen.

Crotalaria striata, *DC.*—Jarrol, Vintang Creek. Plant 2 to 3 feet high.

Crotalaria n.sp. near **anthyllopsis**, *Welw.*—Ballé. Creeping plant 10 feet long. Dramé Joku. Creeper, 10 feet long.

Crotalaria n. sp. near **lanceolata.**—Jinnak. Plant 2 to 3 feet high.

Crotalaria cylindrocarpa, *DC.*—Jinnak. Plant 2 to 3 feet high. —Karnghour, north bank. Soil dry and sandy. Country flat. Plant, 2 to 4 feet high. Seen everywhere.

Country around Karnghour is full of long tall grass and many locust trees. No water seen except at village wells. All the country parched.

Indigofera pulchra, *Vahl.*—Balanghar. Plant 2 to 3 feet long.

Indigofera n. sp. near **I. Perottetii**.—Dramé, north bank. Soil dry and sandy. Indigo plant cultivated in little patches about the villages. Country very flat and dry. Bush of grass very dense.

Indigofera hirsuta, *L.*—Dramé. Plant, creeping, 2 to 6 feet long.

Æschynomene near **uniflora**, *F. Mey.*—Jinnak. Plant 3 feet high.

Erythrina senegalensis, *DC.*—Bakindic Kotu. Tree 6 to 8 feet high. Branches few. Pods burst and fruit difficult to collect. Seen everywhere.

Vigna vexillatta, *Benth.*—Collected in a marsh, Kona village, south bank. Soil very dry and sandy. Country very flat. Plant, long trailing tendrils, 3 to 5 feet long.

The country here is very flat and dry. Large tracts are cleared around the villages for kous. Rubber in large quantities can be had. Water very scarce. Could do no work here for over a fortnight owing to the unfriendly state of the natives.

Mezoneuron benthamianum, *Baill.*—Faraba Sotu, south bank. Soil dry and sandy. Country flat. Tree 25 to 40 feet high. Branches and stem covered with thorns. Country still very dry and parched. Bush fires frequent. Nothing but dense bush about. Very little water to be had.

Caesalpinia pulcherrima, *Sw.*—Government House Garden, Bathurst. Tree 4 to 6 feet high.

Cassia Tora, *L.*—Balanghar. Plant 1 to 3 feet long.

Cassia nigricans, *Vahl.*—Karnghour. Plant 2 to 4 feet high. Seen everywhere.

Cassia mimosoides, *L.*—Gungur. Plant 2 to 5 feet high.

Detarium senegalense, *Gmel.*—Jinnak. Tree 30 to 40 feet high. Wide branches. Common name tallow tree. Fruit called "*Dita.*" Seen everywhere in Gambia.

Entada africana, *G. et P.*—Fruit only.

Parinarium macrophyllum, *Sabine.*—Jinnak. Tree 10 to 15 feet high, with wide spreading branches. Native name Tamba-Kunda. Fruit is eaten, seeds are burnt and ashes used as soap, and bark is powdered and smeared over deap seated pains. Seen everywhere.

Drosera indica, *L.*—Collected in a marsh, Kona village. Entire plant with insects adherent. Branches covered with a dewy, clear, sticky exudation. Very common here.

Guiera senegalensis, *Lam.*—Balanghar. Small tree 3 to 8 feet high. Seen on north and south banks of the Gambia.—Stillite, south bank. Country here is very dry and parched. Bush fires numerous. Little cultivation. No water except at village well.

Combretum mucronatum, *Thonn.*—Balanghar. Tree 12 to 15 feet high. Branches spread out like a large shrub. Also at Gungur. Small tree 10 feet high.

Combretum paniculatum, *Vent.* (**C. comosum,** *Don.*).—N'Jaré. Fruit and specimens collected along the south bank. Stillite. Creeping plant 25 to 40 feet long.—Also at Faraba Sotu. Plant, creeper, 40 feet. —Collected at Bakindic Kotu on the north bank. After the plant attains 5 feet or so it starts to creep up the adjacent trees.

Combretum racemosum, *P. de B.*—Bakindic Kotu. Creeping plant up high trees in swampy soil. Leaves near flowers are white with a pink or purple tinge. The young small leaves are used for killing round worms in children.

Osbeckia near **O. senegambieenis,** *G. et P.*—Collected in a wood beside a grassy swamp, Ma Kuda. Soil was dark and moist. Plant 3 feet high.

Nesæa radicans, *G. et P.*—Bakindic Kotu. Plant 2 to 4 feet high.

Jussiæa linifolia, *Vahl.*—Jinnak. Plant 1 to 3 feet high.—Also at Gungur village. Shrub 2 to 4 feet high.

Mukia scabrella, *Arn.*—Dramé. Creeper. Balanghar. Creeping plant 4 to 8 feet long; on the ground and bushes.

Oldenlandia grandiflora, *Hiern.*—Karnghour. Plant 6 inches to 4 feet high. Seen everywhere.—Torro. Plant 2 to 3 feet high. —Dramé Joku. Plant 2 to 5 feet high. Seen everywhere.

Oldenlandia senegalensis, *Hiern.*—Jinnak, Jinnak Creek. Plant. Native name *Temeng-Temeng.* Collected in the long grass. Seen everywhere.—Also at Torro. Plant 5 feet high. Roots made into native broom. Also used as a worm-killer.

Spermacoce globosa, *S. et Thonn.*—Jinnak. Shrub 2 to 3 feet high. Very common.—Gungur village. Weed, seen in all fields, 1 to 2 feet high. Dried leaves are used for healing ulcers. Very common.

Mitracarpum scabrum, *Zucc.*—Karnghour. Plant 6 in. to 1½ feet high. A weed in all the fields. Leaves are dried and placed over old ulcers, which are said to heal rapidly.

Vernonia senegalensis, *Less.*—Balanghar. Tree 10 to 15 feet high. Common name, Bitters tree. Leaves are chewed for their astringent properties. Seen along north and south banks of the Gambia.

Vernonia pauciflora, *Less.*—Bakindic Kotu. Plant 2 to 5 feet high. Seen everywhere.—At Balanghar, a plant 2 to 3 feet high. Seen everywhere in the fields.

At Kona village, south bank of the Gambia, a shrub very bushy, about 7 feet high.

Vernonia cinerea, *Less.*—Bakindic Kotu. Plant 1 to 3 feet high. Seen also at Karnghour, Ballé, and Torro.

Vernonia Perottetii, *Sch. Bip.*—Karnghour. Plant 2 to 6 feet high. Collected in the fields. Very common.—Seen also at Torro. Plant 3 feet high.

Vernonia nigritiana, *O. et H.*—Torro. Plant 6 inches to 18 inches high. Native name *Jubu Jamba.* Roots are pounded and boiled, and taken as a purgative.

Ageratum conyzoides, *L.*—Collected in a wood beside a grassy swamp, Ma Kuda. Plant 2 to 4 feet high.

Vicoa auriculata, *Cass.*—Bakindic Kotu. Plant 1 to 3 feet high. Seen everywhere.

Blumea lacera, *DC.*—Balanghar. Plant 2 to 4 feet high. Seen only here.

Sphæranthus hirtus, *Willd.*—Jinnak. Plant. Native name, *Cum-mu Cum-mu.* Grows in the rice fields during the dry season. A common weed, seen also at Gungur village.

Gynura cernua, *Benth.*—Collected in a marsh, Kona village. Plant 2 to 4 feet high, with long shoots.

Plumbago zeylanica, *L.*—Balanghar. Plant, sort of creeper, 2 to 4 feet long. Branches have a sticky moist feeling.

Strophanthus sarmentosus, *DC.* — N'Jaré. Creeper 40 feet long. Very few trees at present flowering. Kona village.

Baissea multiflora, *A. DC.*—Gungur village. Creeper, rubber, 30 to 60 feet long. Stem, diameter 3 inches. Bark used as a rope.

Calotropis procera, *R. Br.*—Ballé. *Fouftan* tree 3 to 12 feet high. Seen all over the Gambia. All parts of the tree have a milky juice. It is very difficult to preserve against insects and mildew. It is said to be a good thing for sprains, headaches, and other pains. The leaves are applied warm to the affected part.

Usteria guineensis, *Willd.*

Enicostema littorale, *Blume.*—Bakindic Kotu. Plant 1 to 2 feet high. Soil swampy.

Schultesia senegalensis, *Baker.*—Entire plant, collected in a marsh, Kona village.

Heliotropium indicum, *L.*—Gungur village. Shrub 2 to 4 feet high. Native name *Cock's Comb.* An infusion is used in Gonorrhœa.

Ipomœa Bona-nox, *L.* — Government House Garden, Bathurst. St. Helena moon flower. Creeper 20 to 30 feet long.

Ipomœa involucrata, *P. de B.*—Collected in a wood beside a grassy swamp. Ma Kuda. Soil dark and moist. 7 to 10 feet long. Light purple flower.

Ipomœa pinnata, *Hochst.* — Balanghar. Creeping plant 6 feet long.

Ipomœa Lesteri, *Baker*, n. sp.—Gungur village. A convolvulus 30 feet long or so.

Hewittia bicolor, *W. & A.*—Ma Kuda. 4 to 8 feet long. Flower delicate cream colour.

Solanum near Melongena, *L.*—Gungur village. Shrub 3 to 4 feet high.

Physalis angulata, *L.*—Jinnak. Shrub 2½ to 6 feet high. Native name *Cubum Pap.* Used as an external counter-irritant.

Scoparia dulcis, *L.*—Gungur village. Plant 4 feet high. Common name *Broom.*—Jarrol, Vintang Creek. Plant 2 to 3 feet high.

Alectra senegalensis, *Benth.*—Jinnak. Small plant. Seen in dry rice fields everywhere. Yellow flower. In a wood beside a grassy swamp.—Ma Kuda. Plant 1 foot high.

Buchnera, n. sp.—Faraba Sotu. Plant 3 to 6 feet high. Grows amongst the high bush grass. Seen everywhere.

Buchnera leptostachya, *Benth.*

Buchnera dura, *Benth.*—Karnghour. Plant 1 to 2½ feet high.—Dramé Joku. Plant 2 to 3 feet high. Native name *Dam-Pan.* Used as a blue-black dye.

Newbouldia lævis, *Seem.*—Stillite. Tree 4 to 8 feet high. Flowers grow on upright stem. Stem has no leaves on it for 2 or 3 feet.—Jarrol, Vintang Creek. Tree 4 to 10 feet.

Kigelia africana, *Benth.*—Ka fundi, 30 miles south of Gungur, along the coast, south bank. Soil dry sand. Country flat. Tree 30 to 40 feet high. Large, long fruit collected.

The country here is very dense bush except at clearings around the villages. At places on the coast are very extensive rice fields. Many palm-wine palms (*Raphia*) are here, also large patches of bamboos. Orange groves numerous. Country parched. Bush fires starting.

Nelsonia campestris, *R. Br.*—Dramé. Creeping plant.

Hygrophila senegalensis, *Anders.*—Jinnak. Plant 2 to 3 feet high, collected in the dry rice fields.

Hygrophila spinosa, *Anders.*—Jinnak. Plant 2 to 4 feet high. In moist ground.

Phaylopsis parviflora, *Willd.*—Jinnak. Shrub 3 feet high. Common name *Pap-leaf.* The leaves are used as a hot fomentation over the spleen in ague-cake. When the shrub is placed in water the seeds burst with a slight crackling sound. Seen everywhere.

Schwabea ciliaris, *Nees.*—Ballé. Plant 3 feet high.

Lantana Camara, *L.*—Government House Garden, Bathurst. Shrub 2 to 6 feet high.

Lippia adoensis, *Hochst.*—Stillite. Plant 2 to 3 feet high.

Ocimum basilicum, *L.*—Dramé. Shrub 2 to 4 feet high. Native name *Patmagi.* An infusion made of the leaves is used in fevers. Leaves are also used in soups.—Also at Dramé Joku. Shrub 2 to 4 feet high.

Leucas martinicensis, *R. Br.*—Karnghour. Plant 1 to 2 feet high. Common name Wild tea-bush. The whole plant is made into an infusion and used as a wash in fevers.

Celosia laxa, *Schum. et Thonn.*—Collected in a wood near a marsh in swampy soil, Ma Kuda. Plant with long trailing branches amongst bushes.

Celosia trigyna, *L.*—Bakindic Kotu. Plant 2 to 3 feet high. Seen everywhere.

Loranthus leptolobus, *Benth.* — Gambian mistletoe. Balanghar. Plant 2 feet high. Grows as a parasite on *Mærua.*—Also at Bathurst Garden. Grows in clumps on guava trees.

Jatropha multifida, *L.*—Bathurst Garden. Tree 10 to 12 feet high.

Ricinus communis, *L.*—Balanghar. Castor-oil tree. Seen everywhere near villages.

Gloriosa superba, *L.*—Collected in a wood beside a grassy swamp, Ma Kuda. Soil dark and moist. Stem single creeping along ground 8 feet long. Only specimen seen.

Commelyna nudiflora, *L.*, var. **Werneana,** *Hassk.* Jinnak. A creeping plant on ground and shrubs. Near water. Common name High-grass. Seen everywhere.

Pistia Stratiotes, *L.* — N'Jaré. Aquatic plant growing on the surface of water in large clumps. Native name Eye-pity. Used by the natives as an anodyne eye-wash. Leaves are soaked in cold water. If the plant comes in contact with the body it produces a sharp stinging sensation very like a nettle sting, and the pain continues for some minutes.

At N'Jaré there is a stream of fresh water about 50 yards wide in which this aquatic plant was collected. Nothing else was seen here; stream full of long dried up grass. Much the same trees seen here as before. In the fields small cotton plants cultivated.

Lycopodium cernuum, *L.*—Jarrol, Vintang Creek. In moist soil.

Azolla pinnata, *R. Br.*

Hexagonia polygramma, *Mont.*

Polystictus funalis, *Fries.*

CCXXI.—MISCELLANEOUS NOTES.

The Secretary of State for India in Council has selected, upon the nomination of Kew, Mr. John Horne Stephen, to be head gardener at the Lal Bagh Gardens, Bengalore, under the Durbar of Mysore.

Dr. Stapf's valuable Persian herbarium has been acquired for the Royal Gardens by purchase. It contains about 1,100 species, and will largely augment the collections from that region, which was but poorly represented at Kew, if we except Dr. Aitchison's collection from the extreme east of Persia.

From the Botanical Division of the United States Agricultural Department, Washington, there has been received a very fine set of Mexican plants, collected by Dr. Edward Palmer, and described and published by various American botanists. The Mexican flora seems indeed almost inexhaustible; every fresh collection abounding in new species.

Mr. F. M. Bailey, F.L.S., the active Colonial botanist of the Colony of Queensland, and one of the recent explorers of the Bellenden-Ker range, has sent specimens to Kew of about fifty of his proposed new species.

From Dr. Engler, the Director of the Berlin Botanic Garden, Kew has received a parcel of novelties, chiefly from the collections made by German travellers in tropical Africa.

In connexion with the botanical collections made by Mr. Antwerp E. Pratt, in Western China and Eastern Thibet, at elevations of 9,000 to 13,500 feet, the Principal Assistant in the Herbarium, Mr. Hemsley, F.R.S., has visited Paris, in order to study the novelties collected by Prince Henry of Orleans, and published by Professor Bureau and Mr. Franchet. A considerable number of Mr. Pratt's plants proved to be the same, yet the number of different species was even larger. These will be published as soon as possible.

Two collections of dried Bornean plants have been received from Dr. Haviland, Curator of the Museum at Sarawak, each of about 400 species. The first has been partly worked out by Dr. Stapf the Assistant for India, and has proved rich in novelties, especially in *Melastomaceæ*, of which there are two or three new genera, and at least a score of new species. Among the latter are two species of the singular polyandrous genus *Plethiandra*, Hook. f., previously only known from a very imperfect specimen collected by Motley. There is also a new genus of the *Araliaceæ*, with a calyptrate calyx, and half a dozen Begonias.

Dr. Glaziou has presented a further instalment of his enormous Brazilian herbarium, containing about 700 species.

A small collection of plants made by Mr. Graham Kerr on Captain Page's disastrous expedition up the Rio Pilcomayo (a river rising in Bolivia and separating northern Argentina and Paraguay) proves interesting, though only numbering about 270 specimens. *Prosopis ruscifolia*, Griseb., is a very remarkable plant, having most formidable woody spines 7 or 8 inches long; and there are many undescribed plants in this collection.

The Keeper of the Herbarium, Mr. Baker, has lately proceeded to the Riviera to examine the fine collections of *Yucca*, *Aloe*, *Agave*, *Dasylirion*, &c. growing in the gardens of Mr. Thomas Hanbury, F.L.S., at La Mortola, near Mentone, and others. Mr. Baker has long made a special study of this class of plants, and his visit has proved very instructive. A detailed report of the results will appear in a future number of the *Bulletin*.

An interesting series of apparatus and implements connected with the Gambier industry (*Uncaria Gambier*, Roxb.) of the Straits Settlements has been received from Mr. H. N. Ridley, F.L.S., Director of the Gardens and Forest Department, Singapore. It includes a model of a Gambier factory, with the following implements used in the cultivation and manufacture of Gambier (see *Kew Bulletin*, 1889, pp. 247–253) :—

A knife for cutting the Gambier plant in the field. A chopper for chopping up leaves and twigs before putting them into the boiler. A fork made of the hard wood of the "Tampenis" (*Sloetia sideroxylon*) used for stirring the Gambier leaves in the boiling pan. A basket for bringing the fresh cut leaves to the factory. A rubbish basket for taking away the exhausted leaves, which are thus carried to the pepper plantations or Gambier fields for manure. A tub for holding liquid Gambier; in this tub the Gambier is set. Stick of "Mahang" wood (*Macaranga hypoleuca*) used in setting the liquid. A coarse strainer used for taking the spent leaves out of the boiler. A cocoanut-shell strainer fixed to a kind of sieve by the handle so that it hangs down in the boiling Gambier. When the larger *débris* has been taken out by the coarse strainer, the smaller bits drop into the cocoanut shell and are then removed.

The collection of vanilla pods in the Museum of Economic Botany (No. ii.), has recently been revised and augmented by a series illustrating the principal kinds now known in English trade, including the following sorts:—Madagascar, Bourbon, Réunion, Mauritius, Seychelles, Bahia, Mexico, Java, and "vanillons" (the less valuable sorts of vanilla).

A large supply of the "butter nut" of British Guiana (*Caryocar nuciferum*) was received from Mr. G. S. Jenman, F.L.S., Superintendent of the Botanical Gardens, Georgetown, Demerara. The tree yielding these nuts is a very valuable timber tree as well as a fruit-yielding tree, and its successful introduction to the tropical parts of the Old World, has been a matter of solicitude on the part of Kew for some years. An attempt made in 1888 apparently failed. The present supply of nuts has been distributed to the botanical establishments at Calcutta, Madras, Queensland, Lagos, Ceylon, Mauritius, Singapore, Natal, while some were sown at Kew.

A very fine, and probably a unique, plant of *Yucca filifera* was presented to the Royal Gardens by Mons. de Falbe, Villa Valetta, Cannes, and placed in the Temperate House. This specimen is 25 feet high, and about 3 feet in diameter at the base. It is a magnificent plant in size and character, and although it has lost its terminal crown of leaves, owing to injury during transit, it is hoped that it will eventually recover. The species is figured in the *Botanical Magazine*, tab. 7197, from a specimen received at Kew in 1888. When it arrived it was apparently dead, and the trunk was placed in the Museum of Economic Botany (No. iii). After remaining there for two years in a dormant condition it put out rudimentary leaves, and it ultimately flowered. The plant was then removed to the Temperate House, where its inflorescence was fully developed in September 1890.

The subject of Ramie has once more been brought forward in France, and a trial of methods and appliances for decorticating and preparing Ramie was held at Paris under the auspicies of *The Société des Agriculteurs de France* on the 25th to the 30th September last. It will be recollected by those who take an interest in this subject that previous trials were held at Paris in 1888 and 1889, and owing to the importance of Ramie as a possible industrial plant for India the Secretary of State for India in Council sanctioned an arrangement whereby the Assistant

Director of Kew was enabled to attend the trials and prepare reports embodying the results for the information of the India Office. A summary of these reports was afterwards published in the *Kew Bulletin* for November and December 1888, and November and December 1889. At the trials in September last the Director of Kew was able to be present as representative for India, and the results, which have just been worked out, will, by permission of the Secretary of State for India in Council, be shortly published in the *Kew Bulletin.* The trials took place this year at Gennevilliers, a suburb of Paris, in a field where Ramie (the white-leaved sort) had been grown specially for the purpose. After the trial of the decorticators had been completed the ribbons were afterwards passed on to be treated by the chemical processes so as to test exactly the amount of filasse (or marketable fibre ready for spinning) produced by each system. The chemical processes have necessarily occupied some time, but as the report by the jury and the awards have been officially made known there will be sufficient evidence forthcoming to enable a tolerably clear estimate being formed of the advance which has been made towards solving the difficulties hitherto connected with the Ramie question.

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 60.] **DECEMBER.** **[1891.**

CCXXII.—HISTORICAL ACCOUNT OF KEW TO 1841.

On the 1st of April 1841 Sir William Hooker, who had previously been Regius Professor of Botany in the University of Glasgow, commenced his duties as Director of Kew. The year 1891 therefore marks the jubilee of the establishment as a national institution.

It appeared to me that the occasion might appropriately be marked by giving some account in the pages of the *Kew Bulletin* of the origin and development of the Royal Gardens as a place of botanical study. The task is not an easy one, as scarcely any authentic records exist of the period prior to 1840, when the Gardens were a purely private possession of the Crown. I have therefore had to fall back on local tradition, on local histories, the statements in which are often confusing and inaccurate, and on such scattered notices as could be gathered from contemporary literature.

The present account only goes as far as 1841. The history of the last half century will be given in another number.

I am quite aware that what I have written is open to the criticism that it might have been stated with greater brevity. But I have

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Twopence.

thought it best to sift the available material, and to print *verbatim* the statements which seem to be fairly accurate. For official purposes the need has often been felt of such a historical account as I have attempted to compile. And it is from this point of view extremely convenient to give the exact authority on which any particular statement rests.

In order to save space in the citation of references I add a list of the books from which the information has been drawn.

The Rarities of Richmond: being Exact Description of the Royal Hermitage and Merlin's Cave. Second ed. 1736.

A Morning's Walk from London to Kew. By Sir Richard Phillips. 1817.

Richmond and its Vicinity. By John Evans, LL.D. Second ed. 1825.

Kew and its Gardens. By Frederick Scheer, Esq. 1840.

The History of Kew. By Edward Simpson. [Privately printed, 1849.]

Wanderings through the Conservatories at Kew. [By Philip Henry Gosse, 1856.]

Records of the Royal Botanic Gardens, Kew. [By John Smith. Privately printed, 1880.]

Kew: Past and Present. By Q.C. and Edward Walford, M.A. [Privately printed, 1884. Pages 389–424 are reprinted from Walford's "Greater London."]

The History of the Kew Observatory. By Robert Henry Scott, M.A., F.R.S., Secretary to the Meteorological Council. Proc. R.S. Lond., vol. xxxix. (1885), pp. 37–46.

A Sketch of the Life and Reminiscences of John Rogers. 1889.

W. T. Thiselton-Dyer.

Early History.

Although not one of the oldest institutions, the early history of Kew commences with a myth. In Flückiger and Hanbury's Pharmacographia (2nd ed., 1879, p. 767) "the foundation of the Kew Gardens" is attributed to William Turner, who died in 1568. This idea seems to have had its origin in a passage in Pulteney's "Historical and Biographical Sketches of the Progress of Botany in England" (1790, vol. i., p. 63), where the author, in his account of Turner, remarks:—"He also speaks of his garden at Kew."

The existence of anything like a botanic garden at Kew in the sixteenth century is certainly a curious coincidence, and the national establishment which now exists could not have had a worthier founder than "the Father of English Botany." But unless contiguity to the neighbouring domain of Sion (where, according to Pulteney (i., 55) Turner "seems to have had the direction" of the garden of the Duke of Somerset) had some faint influence on the formation of botanical collections at Kew, Turner has no real place in its history. Even the site of his garden at Kew is unknown.

The mention of so remarkable a man in connexion with Kew will justify, however, a few words as to his history. He was born at Morpeth in Northumberland, and was educated at the expense of Lord Wentworth at Cambridge, a university which has produced a succession of distinguished English botanists. At the University he was associated with Latimer and Ridley, and throughout his life adhered unflinchingly to the principles of the Reformation. He became a Fellow of Pembroke College in 1530. In 1548 he published "*The Names of Herbes.*" At this time he was physician to the Duke of Somerset, Lord Protector. and the preface is dated from Sion House, then the residence of the latter, to whom the book is dedicated. It contains many localities of native plants, chiefly about Sion. Turner seems, however, to have lived also at Kew, for Mr. Daydon Jackson, in his reprint of Turner's first publication, "*Libellus de re Herbaria Novus*" (1538), prints a letter concluding with "farewell from Kew," which appears to have been written in 1549.

Turner's Herbal (first part, 1551; second part, 1562; reprint with third part, 1568) was the real starting point of scientific botany in England. It contains a reference to Kew, which is no doubt the authority for Pulteney's statement.

> "Cicer is muche in Italy and Germany. I have seen them in the gardine of the barbican in London, and I haue it in my garden at Kew. Cicer may be named in English ciche or ciche pease, after the Frenche tonge."

The complete edition of the Herbal is dedicated to Queen Elizabeth. He recalls that he had conversed with her in Latin at Sion (before she had ascended the throne), and assures her that he "neuer spake "with any noble or gentle woman that spake so wel and so much "congrue fyne a pure Latin."

In 1550 Turner was made Dean of Wells, though not ordained priest till 1552. He was also a member of the House of Commons. He died 1568.

RICHMOND GARDENS.

Kew, as it exists to-day, was formed by the fusion of two distinct properties or domains, both Royal, but with entirely different histories. They corresponded roughly to the west and east halves of the present gardens. The western half was known as Richmond Gardens. The eastern half corresponds in great part to the grounds of Kew House, and to this the name of Kew Gardens was originally confined. The two properties were separated by Love Lane, the ancient bridle road between Richmond and Brentford ferry.

Evans (pp. 18–24) says that the Old Palace at Richmond was originally "the Manor House at Sheen." It was made a royal palace by Edward I. Henry VII. rebuilt it after a fire, and gave it the name of Richmond. He died there April 29, 1507; as did Queen Elizabeth, March 24, 1603. Charles II., by order of Parliament, was sent to be educated at Richmond. In 1650 it was sold for 10,000*l*. "In this "old Palace, according to Bishop Burnet, the son of James the "Second, commonly known by the name of the Pretender, was "nursed." Nothing now remains of it but the old Gateway on the Green.

The Old Park (in contradistinction to the New Park, now known as Richmond Park) lay to the north of the palace. Evans says (pp. 28, 29):—

> "Its lodge was once occupied by Cardinal Wolsey in his disgrace. 'The Cardinal,' says Stow, 'having license to repair to Richmond, was there lodged 'within the lodge of the Great Park, which was a very prettie house; there my Lord 'lay until Lent, with a prettie number of servants!' He afterwards removed to the priory."

In the Kew Museums there is a map by Jean Rocque, dated 1734, and entitled "Plan of the House Gardens, Park, and Hermitage of "their Majesties at Richmond; and of their R.H. the Prince of Wales "and the Princess Royal at Kew."

An inscription on the map gives the following account of how the house and land came into the possession of Queen Caroline, wife of George II.

> "His Maj : our late Gracious K : W : III. for y^e gallant behaviour of y^e D : of O[rmonde] (against y^e Enemy) granted this Place to him, on w^{ch} he founded and almost finish'd y^e House &c. but in the 1st of K : G : I. y^e said D : being attainted it devolv'd to y^e Crown and by his present Maj : in Parl^t was confirm'd to his Q : (if she survives as Dowager Q : of Eng :) at whose Expence it is made compleat being augmented with Buildings and sundry large parcles of Ground purchas'd to enlarge y^e Gardens Park &c. all curiously (and at no small Expence) adorn'd in so exquisite a manner as renders it second to none in y^e Kingdom.
>
> "It is beautify'd with regular Rows of Trees, Walks, Groves, Arbours, Statues &c. At a distance you view the Park, Fields, River, City, and at a remoter Prospect y^e Country all around w^{ch} renders it one of y^e most delectable Places in y^e Land. Near this Place stands Kew Pallace The seat of his Royal Highness y^e Prince of Wales, a compleat Place very beautifull in its Situation, Gardens &c. all laid out at his Hignesses expence and affords a delightfull Prospect of y^e River and the opposite Country."

A somewhat different story is given by Scott :—

> "Richmond Lodge, which in its turn became the Palace of Richmond, was apparently originally the Lodge of the Palace Park, the old Deer Park" (p. 39).
>
> "Richmond Lodge or House (once occupied by Cardinal Wolsey) . . . . had been granted in 1707 by Queen Anne to the Duke of Ormonde, and partly rebuilt by him, in the year 1708–9, on the site of an old building which had likewise borne the name of a lodge for a long period of years. On the impeachment of the Duke in 1715, he hastily left the country and resided at Paris. Ormonde House was apparently unfinished at the time. The Earl of Arran, his brother, who purchased the property, then leased for the term of about ninety years, sold the lease to the Prince of Wales, afterwards George II., of whom, both before and after his succession to the throne, it was a favourite place of residence, and even more particularly so of his Queen (Caroline)" (p. 41).

Queen Caroline is believed to have spent large sums on Richmond Gardens. Simpson (p. 45) quotes Walpole :—"One of the Queen's "delights, was the improvement of her Garden, and the King believed "she paid for all with her own money; nor would he ever look at "her intended plans, saying 'he did not care how she flung away her "own revenue.'" Simpson continues :—"He little suspected the aid "Sir Robert Walpole (then Minister) furnished to her from the "Treasury: when she died she was in debt to the King, to the "amount of 20,000*l*."

Queen Caroline died in 1737 and George II. in 1760. Up to this date Richmond Gardens remained unchanged. The following clear and apparently accurate account of them is given in Chamberlain's "History and Survey of the Cities of London and Westminster" (p. 627). This was published in 1769; but it is practically identical with the account in "London and its Environs," published in 1761.

> "The present palace, which is delightfully situated, is a plain edifice built by the duke of Ormond, who received a grant of a considerable space of land about Richmond, from King William III. as a reward for his military services; but on the attainder of that duke in the beginning of the reign of King George I., it devolved to the crown, and it was by his late majesty confirmed to queen Caroline, in case she became queen dowager of England.
>
> "The King took great delight here, and made several improvements in the palace, while her Majesty amused herself at her royal dairy house, Merlin's cave, the Hermitage, and the other improvements which she made in the park and gardens of this delightful mansion.

"The gardens are extremely fine, and are formed with an agreeable wildness and pleasing irregularity, that cannot fail to charm all who are in love with nature, and afford a much higher and more lasting satisfaction than can possibly arise from the most extensive decorations of art.

"On entering these rural walks, you are conducted to the dairy, a neat but low brick building, to which there is an ascent by a flight of steps; in the front is a handsome angular pediment. The walls on the inside are covered with stucco, and the house is furnished suitable to a royal dairy, the utensils for the milk being of the most beautiful china.

"Proceeding through a grove of trees you come to the temple, which is situated on a mount. It is a circular dome crowned with a ball, and supported by Tuscan columns, with a circular altar in the middle, and to which there is an ascent by very steep slopes.

"Returning by the dairy, and crossing the gravel walk which leads from the palace to the river, you come to a wood, which you enter by a walk terminated by the queen's pavilion, a neat elegant structure, wherein is seen a beautiful chimney-piece, taken from a design in the addition to Palladis, and a model of a palace intended to be built in this place. In another part of this wood is the duke's summer-house, which has a lofty arched entrance, and the roof rising to a point is terminated by a ball.

"From the wood you come to the summer-house on the terrace, a light small building with very large and lofty windows, to give a better view of the country, and particularly of that noble seat called Sion House. In this edifice are two pictures, representing the taking of Vigo by the duke of Ormond.

"Passing through a labyrinth, you see, near a pond, Merlin's cave, a Gothic building thatched; within which are the following figures in wax, Merlin, an ancient British enchanter; the excellent and learned queen Elizabeth, and a queen of the Amazons; here is also a library consisting of a well chosen collection of the works of modern authors neatly bound in vellum.

"On leaving this edifice, which has an antique and venerable appearance, you come to a large oval of above five hundred feet in diameter, called the Forest oval, and turning from hence you have a view of the Hermitage, a grotesque building, which seems as if it had stood many hundred years, though it was built by order of her late majesty. It has three arched doors, and the middle part which projects forward, is adorned with a kind of ruinous angular pediment; the stones of the whole edifice appear as if rudely laid together, and the venerable look of the whole is improved by the thickness of the solemn grove behind, and the little turret on the top with a bell, to which you may ascend by a winding walk.

"The inside of this building is in the form of an octagon with niches, inwhich are the busts of the following truly great men, who by their writings were an honour not only to their country, but to human nature. The first on the right hand is the incomparable Sir Isaac Newton, and next to him the justly celebrated Mr. John Locke. The first on the left hand is Mr. Woolaston, the author of the Religion of Nature Displayed; next to him is the reverend and learned Dr. Samuel Clarke, and in a kind of alcove is the truly honourable Mr. Robert Boyle.

"From this seat of contemplation you pass thro' fields clothed with grass; through corn fields, and a wild ground interspersed with broom and furze, which afford excellent shelter for hares and pheasants, of which there are great abundance.

"Leaving this beautiful variety, in which nature appears in all her forms of cultivation and barren wildness, you come to an ampitheatre formed by young elms, and a diagonal wilderness, through which you pass to the forest walk, that extends about half a mile, and then passing through a small wilderness you leave the gardens.

"At the north-east extremity of the garden is another house that belonged to her majesty, and near it the house of his late royal Highness Frederick prince of Wales, which is on the inside adorned with stucco. Opposite this last house is the princess Amelia's, built by a Dutch architect, the outside of which is painted."

The "Forest walk" as shown on Rocque's plan was an avenue of trees which ran from near the present Palace to Richmond Green, a distance of considerably more than a mile. The wilderness was called the "Wilderness near Richmond."

It appears from Walpole, quoted by Johnson (History of English Gardening, p. 262), that the Richmond Gardens were laid out by Bridgeman.

"Bridgeman was the next fashionable designer of Gardens . . . . . He enlarged his plans, disdained to make every division tally to its opposite, and though he still adhered much to strait walks with high clipt hedges, they were only his great lines; the rest he diversified by wilderness, and with loose groves of oak, though still within surrounding hedges. . . . . As his reformations gained footing, he ventured farther, and in the Royal Garden at Richmond, dared to introduce cultivated fields, and even morsels of a forest appearance."

Bridgeman introduced the sunk fence "as a boundary instead of walls and other opaque partitions."

"Here," says Scott (p. 41), "in the garden appertaining to their lodge, took place the interview between Queen Caroline and Jeannie Deans, after her journey on foot from Edinburgh to plead for the life of her sister Effie, which has been so graphically and so touchingly described by Sir Walter Scott in his 'Heart of Midlothian.'"

There is some reason to think that George III. contemplated at first making the Richmond Gardens a royal residence. In the Kew Museums there is a manuscript plan entitled "Richmond Gardens with the proposed alterations, December 10, 1764." The scheme, which was probably the work of Brown (1715–82), included the whole of the Deer Park. It eliminates all the work of Queen Caroline, and redisposes the ground in the modern landscape fashion.

George III. certainly resided at Richmond or Ormond Lodge, as it was apparently indifferently called, in the early part of his reign.

John Rogers gives some particulars of the local history of this date. He was a gardener 'in the Royal Gardens at Richmond, then under the "Superintendence of Mr. John Haverfield, who was recommended to His "Majesty King George III. by Lord Bute" (p. 21).

Before this he had been—

"to Richmond Lodge, to see the beautiful display of fireworks given by His Majesty King George III. to Christian VII. King of Denmark, in honour of the nuptials [1766] of his sister, the Princess Carolina Matilda with the Danish King . . . . The fireworks were mostly exhibited upon a large pond, near the Lodge, which was full of gold, silver and other fishes" (p. 19).

A few other facts may be quoted to illustrate a part of the history of Kew, of which so little is known.

"During my stay in the Royal Gardens, I had frequent opportunities of seeing the King, who at this time resided in a domestic manner at Ormond Lodge. He would often walk to where we were at work, and occasionally ask us questions." (p. 26).

"Very near the house was a small flower garden in which the Queen took particular interest. I remember assisting Ramus, the Queen's Page, planting some tulip roots (a flower Her Majesty was particularly fond of) under her immediate direction, but all traces of this garden have long been swept away. After the death of the Queen's mother [1772], his Majesty retired to Kew" (p. 27).

All trace of Queen Caroline's occupation was eventually obliterated. Scott (p. 42) quotes from Crisp's "Richmond":—

"A few years after the accession of George III., the public, more especially of Richmond and Kew, were surprised to learn that it was His Majesty's intention to pull down the whole of the buildings and convert the estate into a large pasturage for cattle, which intention was duly carried out."

Crisp, however, quoted by Scott (p. 41), says:—

"It was in the year 1770 that the village or hamlet of West Sheen, with the ancient gateway forming the entrance to, or rather part of, the priory, and eighteen houses with large pieces of ground attached, were pulled down, and the entire site converted into park or pasture land, as we now see it."

He continues:—

"Of this famous Richmond Lodge, its magnificent gardens, the statuary, and the numerous and singular buildings with which the Queen of George II. had at such an extraordinary outlay enriched the place, the remains of the ancient monastery of Sheen, the large and embattled Gothic entrance, and the numerous houses still appertaining to the hamlet—we have now not a vestige left."

Brown got the credit of the destruction. Evans (p. 30) quotes from Mason's "Heroic Epistle to Sir William Chambers" (1773) :—

> "Come then, prolific Art, and with thee bring
> The charms that rise from thy exhaustless spring;
> To Richmond come, for see untutor'd *Brown*
> Destroys those wonders that were once thy own.
> Lo! from his melon ground the peasant slave
> Has rudely rush'd and level'd *Merlin's Cave*,
> Knock'd down the waxen wizard, seized his wand,
> Transform'd to lawns what late was fairy land;
> And marr'd with impious hand, each sweet design
> Of *Stephen Duck* and good QUEEN CAROLINE!"

The augmentation of the property stated by Rocque must have consisted of land to the north. Richmond Gardens finally extended to the neighbourhood of the Horse Ferry at Brentford, and absorbed all the available land between what was afterwards Kew Gardens (from which they were only separated by Love Lane) and the river.

At the extreme northern apex of the property the Queen, as stated by Chamberlain, had a house which in Rocque's plan is called the "Queen's House at Kew." It was almost next door to the present Kew Palace, being only separated from its out-buildings by the end of Love Lane. There is a tradition that it belonged to Sir Richard Levett, who also purchased the present palace in 1697.

The dogs on the piers at the present entrance to the palace were stated by the late John Smith to have been placed there by Decimus Burton in 1847, and to have come from the gateway to Levett's house. The Queen's house was pulled down by George III. Its exact history has been a good deal confused with that of the palace which in Rocque's plan is called the "Princess Royal's House."

MERLIN'S CAVE.

Among the buildings destroyed by George III. were two which notwithstanding their trivial character have enjoyed a reputation which a good deal exceeds their intrinsic interest. These were the Hermitage and Merlin's Cave. The latter was a sort of thatched summer-house of wood and plaster with queer conical bee-hive roofs. It is probably the "Keeper's House" of Rocque's map, which was near the river. The name has been transferred on the Ordnance map to a rockery with a small stone house and a sort of underground cellar which existed till recently near the Temperate House in a remote part of the grounds. From a letter of John Smith it appears that this was constructed by the sons of George III. with the help of a bricklayer. Having become overgrown and obsolete, the materials were used in 1882 for the construction of the Rock Garden in the Botanic Garden.

The site of Ormond House is not certainly known, but it was apparently in the northern part of the Old Deer Park near the Queen's Cottage Grounds.

Evans (p. 127) says (1824) :—

"Richmond Gardens adjoining the Old Park are now connected with Kew Gardens. In this Park . . . stood a Palace of George the Second, a favourite spot with his Queen Caroline of literary celebrity. But this ancient structure having been demolished, another was begun, even to the turning of the arches, but never completed. The Garden with Merlin's Cave and other decorations being vanished, an observatory, devoted to science, raises its dome and dignifies the scenery."

Observatory.

The observatory was built for George III. in 1769 by Sir William Chambers for the purpose of observing the transit of Venus which occurred in that year. The old observatory in Kew House had fallen into disuse.

The Rev. Stephen Demaimbray succeeded his father Dr. Demaimbray in 1782 as superintendent of the observatory. He retired on a pension in 1840, when the observatory was abandoned by the Royal family. Latterly he was assisted by his nephew Professor Rigaud, who took charge of the observatory during the Oxford vacations.

Evans (p. xi) describes in 1824 the changes which had taken place in the Deer Park, as pointed out to him by Rigaud :—

> " Strolling one day into Richmond Gardens to ascertain where the old favourite Palace of George the Second and of Queen Caroline with its far-famed adjacent Merlin's Cave stood, the author had the good fortune to meet there S. P. Rigaud, Esq., of the Royal Observatory, Savilian Professor of Geometry, Oxford, and distinguished for his mathematical attainments . . . . . He very politely pointed out to him, though a stranger, the spot where these edifices were once to be found. Two hawthorn bushes, now blown down by the wind, till lately indicated where this residence of kings extended its broad foundations, and reared its turrets to the sky. [As a matter of fact it was a very plain house, destitute of turrets.] Even its ruins have disappeared. It is swept into oblivion . . . . Richmond Gardens existed, and were in the zenith of their popularity before Kew Gardens emerged into distinction. But it has been stripped of its horticultural beauties, which fringed the banks of the Thames, here rolling along its waters with a placid equability. The shady rows of chestnut trees, which constituted an entrance to the Palace from the Green, have also vanished ; cut down it is said with a number of fine elms ; the latter were used in constructing the common sewers of the metropolis of Scotland ! Indeed this truly celebrated spot is reduced to an humble, but spacious plot of meadow ground, stretching from near the Pagoda, at the southern extremity of the Kew Gardens, to the village of Richmond."

The " Terrace " spoken of by Chamberlain can still be traced, though it is now only a turfed avenue by the river.

Evans (p. 130) on the authority of " a respectable friend, of Brentford," says :—

> " A terrace near the river was frequented, especially on Sunday evening, with a concourse of nobility and gentry ! Stars and ribbons and garters glistened on the eye in uninterrupted succession. No music exhilarated the company, but the translucent stream of old father Thames glided by with an equable and enviable placidity."

The actual topographical history of the Richmond Gardens, as they now form part of the Pleasure Grounds, is extremely difficult to trace. A path starting from the side of Kew House and running across the Palace lawn takes a further course through the Pleasure Grounds, and ends at the head of the Hollow Walk. It is known traditionally as the Princess's Walk. Another walk starting from the same point at the head of the Hollow Walk skirts the Azalea Garden. This is called the Stafford Walk. The local tradition is that these three walks, the Princess's, Stafford, and Hollow Walk, were made in the reign of George III. by the Staffordshire Militia when quartered at Kew, and at the expense of the Dowager Princess of Wales. The Hollow Walk, which is one of the prettiest features in the grounds, is shown on a " Plan of the Royal Manor of Richmond " made by Thomas Richardson for Peter Burrell, Esq., His Majesty's Surveyor-General in 1771. A copy of this has been lent to the Kew Museums by Her Majesty the Queen. The Hollow Walk (and the others) must therefore have been made between 1760 and 1771. They were probably designed by Brown.

LOVE LANE.

In 1765 an Act of Parliament was passed giving George III. power to shut up Love Lane, which separated Kew and Richmond Gardens:—

> "It shall and may be lawful to and for His Majesty, His Heirs and Successors, at His and their Costs and Charges to cause the said Road by the River Side from the late Horse Ferry at Kew, to West Sheene Lane near Richmond Green, to be shut up and discontinued."

The King undertook to keep the road from Kew Bridge to Richmond in repair as an equivalent. This Act seems to have been ineffective, for in 1785 a further Act was passed empowering the parish of Richmond to elect a vestry. Each vestryman was to take an oath pledging him to perform his duties under the Act, the title of which is recited in the oath, concluding with:—"and also to enable His Majesty to shut up a Lane within the said Parish, called Love Lane." This would at any rate keep the King's wish before the mind of every successive vestryman. According to Scheer, however (p. 17), it was not finally accomplished till 1802.

OLD DEER PARK.

In Rocque's map of 1734 this corresponds to only about the western half of the area of the present Park. "It was used as a kind of hospital-paddock for aged deer." The eastern half was partly occupied by the Kitchen Gardens of Ormond House, and the west was divided up into square fields in arable cultivation. This was also the condition of part of the Richmond Gardens property, now included in the Royal Gardens.

In the early part of the present century George III. enlarged the Deer Park by adding to the east (*i.e.*, north of Kew Gardens proper) some land obtained by exchange from W. Selwyn, Esq., Q.C.

Evans (1825) gives a map in which he marks the Deer Park as "Richmond Old Park." In 1851, 13 acres were taken from the Deer Park, and added to the Queen's Cottage Grounds; for this a rent of 45*l.* 10*s.* is paid to the Woods and Forests.

The Deer Park as it exists is therefore the creation of George III.

The Pleasure Grounds at Kew were placed under Sir W. Hooker by the Woods and Forests, July 9, 1845. Apparently the Old Deer Park was included in his charge. In his report for 1845 he states:—

> "This ground having been let for grazing purposes to a tenant from year to year, little comparatively requires to be done to it, save for the general protection of the property. It is an extensive piece of pasture land, comprising 374 acres, with many noble trees and belts of wood.
>
> "Some parts of the belts have been much injured and denuded by gales and other casualties; these blanks have been filled up to the number of 1,000, with birches and horse-chestnut trees planted this winter, and guarded by a strong rail fence from cattle."

In 1846 the wall between the Pleasure Grounds and the Deer Park was removed.

KEW HOUSE.

Kew House (or the White House) was a substantial private house of no great architectural pretensions, which stood in the private grounds of the present palace, and to the south of it. In the middle of the seventeenth century it belonged to Richard Bennett, Esquire, son of Sir Thomas Bennett, Lord Mayor of London, 1603.

LORD CAPEL.

His daughter and heiress married Sir Henry afterwards Lord Capel of Tewkesbury (a brother of Lord Essex), who died Lord Deputy of Ireland in 1696. Lord Capel was much attached to the culture of plants, and his collections may fairly be regarded as the actual starting point in the botanical history of Kew. Stephen Switzer, writing in 1718 (Ichnographia Rustica, vol. i., p. 58) singles him out as one of the chief horticulturists of the time of Charles II.

> "The Right Honourable the Earl of Essex and the Lord Capel amongst the Nobles; and John Evelyn, Esq., and Sir William Temple amongst the Gentlemen; Cowley amongst the Poets, and Rose amongst the Gard'ners, made up a great part of the Virtuosos of that Reign."

He continues (p. 61):—

> "The Plantations of the Right Honourable the Lord Capel are still to be seen at Kew, over against Brentford. The greatest advance made by him herein was the bringing over several sorts of Fruit from France; and this noble lord we may suppose to be one that had for many years a correspondence with Monsieur de la Quintinye . . . . The Earliness with which this lord appeared in Gard'ning, merits a very great place in this History, and a better Pen than mine to draw it."

John Evelyn in his "Diary" under date of August 30, 1678, writes:—

> "Hence I went to my worthy friend Sir Henry Capel (at Kew), brother to the Earle of Essex; it is an old timber house, but his garden has the choicest fruit of any plantation in England, as he is the most industrious and understanding in it."

The house inhabited by the Prince of Wales must have been a different structure from that which Evelyn saw. From contemporary prints it was a plain building in the Georgian style probably stuccoed and painted.

Again, under date of March 24, 1688, Evelyn writes:—

> "From thence we went to Kew to visit Sir Henry Capel's, whose orangery and myrtetum are most beautiful, and perfectly well kept. He was contriving very high palisados of reeds, to shade his oranges during the summer, and painting those reeds in oil."

J. Gibson wrote—

> "A short Account of several Gardens near London, with remarks on some particulars wherein they excel, or are deficient, upon a view of them in December 1691."

This was read to the Society of Antiquaries, July 3, 1794, and is published in vol. xii. of the Archæologia.

He gives the following account of the garden at Kew House:—

> "Sir Henry Capell's garden at Kew has as curious greens, and is as well kept as any about London. His two lentiscus trees (for which he paid forty pounds to Versprit) are said to be the best in England, not only of their kind, but of greens. He has four white striped hollies, about four feet above their cases, kept round and regular, which cost him five pounds a tree this last year, and six laurustinuses he has, with large round equal heads, which are very flowery and make a fine show. His orange trees and other choice greens stand out in summer in two walks about fourteen feet wide, enclosed with a timber frame about seven feet high, and set with silver firs hedge-wise, which are as high as the frame, and this to secure them from wind and tempest, and sometimes from the scorching sun. His terrace

> walk, bare in the middle, and grass on either side, with a hedge of rue on one side next a low wall, and a row of dwarf trees on the other, shows very fine, and so do from thence his yew hedges with trees of the same at equal distance, kept in pretty shapes with tonsure. His flowers and fruits are of the best, for the advantage of which two parallel walls about fourteen feet high, were now raised and almost finished. If the ground were not a little irregular, it would excel in other points, as well as in furniture."

Loudon (Arboretum, vol. i., p. 45) in referring to this account explains that by "greens," evergreens are to be understood.

Lady Capel survived her husband, and resided at Kew for many years. She died in 1721, and Kew House then passed to Samuel Molyneux, Esquire, Secretary to George II. when Prince of Wales. He had married Lady Elizabeth, grand-niece of Lord Capel. Mr. Molyneux was a scientific man, and constructed a telescope, with which, in 1725, Dr. Bradley discovered the aberration of light and the nutation of the earth's axis. Kew House having been taken down in 1803, William IV. erected a sun-dial (1832) to commemorate the site of the observatory, which seems to have been in the east wing of the house.

Simpson (p. 23) says:—

> "About the year 1730, Frederick Prince of Wales obtained a long lease of Kew House from the Capel family, soon after which he commenced a fresh arrangement of the pleasure grounds, which were laid out, and additional plantations made, under the direction of the celebrated Kent, who was also engaged in the decoration of the house itself."

The Prince of Wales died in 1751. His widow, the Princess Augusta of Saxe Gotha, Dowager Princess of Wales, continued to live at Kew. She died in 1772, but in the preceding 20 years she gave to Kew Gardens the definitely scientific character which they have ever since retained.

In 1759 William Aiton, who had been a pupil of Philip Miller (born in 1691, and the only man whom Pulteney knew who had seen the botanist Ray) at the Physic Garden, Chelsea, was engaged by the Dowager Princess to establish at Kew a Botanic, or as it was then called, a Physic Garden. John Haverfield was the chief gardener.

JOHN HAVERFIELD.

Haverfield, it appears from Rogers (p. 21), was recommended by Lord Bute. On the death of George II. in 1760, Haverfield seems to have been put in charge of the Richmond and Aiton of Kew Gardens. Haverfield died October 29, 1784, age 90, and Aiton then succeeded to the entire management of both the Royal Gardens at Kew and Richmond (Rogers, p. 25).

GREAT STOVE.

In the next few years very extensive works were carried out, and no pains seem to have been spared to get help from the most competent people. In the Correspondence of Linnæus (vol. ii., pp. 41, 42) there is a letter (1758) from the distinguished physiologist, the Reverend Dr. S. Hales, F.R.S., describing his plan for warming a large plant house which the Princess proposed to erect.

> "The Princess will build a hot greenhouse, 120 feet long, next spring, at Kew, with a view to have exotics of the hottest climates, in which my pipes, to convey incessantly pure warm air, will probably be very serviceable. And as there will be several partitions in the greenhouse I have proposed to have the glass in some of

> the rooms covered with shutters in winter, to keep the cold out, which will make a perpetual spring and summer, with an incessant succession of pure warm air. What a scene is here opened for improvements in greenhouse vegetation!"

It is probable that the building referred to was the large hothouse, 110 feet long, which, according to the privately printed "Records of the Royal Botanic Gardens, Kew," by the late John Smith, A.L.S. (p. ix)—

> "was erected [in 1761] by Sir Wm. Chambers, then Royal architect, being at that time the largest hothouse in this country, and in after years known as the Great Stove."

It stood not far from the Temple of the Sun, and was taken down in 1861; the old *Wistaria sinensis*, which is coiled on a circular frame, was trained on its brickwork. Gosse gives a view of it (Wanderings, p. 205).

Chambers gives the following account (p. 3) of this stove in the description which he published in 1763 (at the expense of the Princess Dowager) of the buildings and gardens at Kew:—

> "The Physic or Exotic Garden was not begun before the year 1760; so that it cannot possibly be yet in its perfection; but from the great botanical learning of him who is the principal manager [no doubt Lord Bute], and the assiduity with which all curious productions are collected from every part of the globe, without any regard to expense, it may be concluded that in a few years, this will be the amplest and best collection of curious plants in Europe. For the cultivation of those plants I have built several stoves; and amongst others a very large one, of which there are the plans, elevations, and sections in the seventh plate. Its extent from east to west is one hundred and fourteen foot; the center is occupied by a bark-stove sixty foot long. . . . .

* * * * * *

> "The back-stove in the center is heated by four furnaces; two of these serve to warm the flues under the pavement, and two to warm those in the back wall, of which there are five revolutions. The flues are all of them 9 inches wide and two foot high. Those in the back-wall are divided from the house by a brick-on-edge wall, and separated from each other by foot-tiles. Between some of them are placed air pipes for the introduction of fresh air, which by that means is warmed in its passage, and becomes very beneficial to the plants.

* * * * * *

> "On the outside of the back-stove, in front, there is a border covered with glass for bulbous roots, which by the assistance of the flues under the pavement of the stove flourish very early in the year."

The method described of growing Cape bulbs in this country is undoubtedly the best. Smith (Records, pp. 312, 313) says:—

> "The garden collection of bulbs were grown in glazed frames, called the bulb borders, attached to the fronts of the Botany Bay, Cape, and Palm Houses, the length of the whole being 234 feet, width 5 feet. They received heat from the flue that heated the house, through openings left in the brickwork, and in severe winters they were protected by shutters. In these borders the principal of Niven's, Masson's, and Bowie's collections were well maintained for many years. In consequence of the alterations and improvements in the garden which followed the appointment of Sir W. Hooker as Director, these houses and pits were removed."

The system has since been reverted to.

EARL OF BUTE.

John Stuart, third Earl of Bute, took an extremely active part in developing the botanical side of Kew. He had been lord of the bedchamber to the Prince of Wales, and on his death became groom of the stole to his son, afterwards George III. George II. died in 1760, and in 1761 Lord Bute was made Secretary of State, and for a short time (1762–3) Prime Minister. He took throughout his life a keen interest in botany, and died in 1792 a victim to his favourite pursuit. "Seeing a new plant on the cliff [near Christchurch, in Hampshire], "he climbed towards it, and received a severe fall, which brought on "an illness of which he died."

Lord Bute's interest in botany has scarcely received the appreciation it deserved. It was undoubtedly real, and was, in fact, apart from his brief political career, the principal occupation of his life. In the "Memoir and Correspondence" of Sir J. E. Smith (vol. i., p. 402), a letter from Dr. Pulteney, dated Blandford, October 14, 1792, is printed, describing Lord Bute's botanical library in Hampshire:—

> "I had lately, in my attendance upon one of the family, an opportunity of spending a few hours in the botanical library of the late Earl of Bute. It is, indeed, very rich in books and dried specimens, as well as in volumes of paintings of plants; and it appears that the Earl preserved his taste to the last, as I observed all the latest expensive works. There are (thick and thin) more than 300 folios, *strictly* botanical, and quartos and octavos in proportion; very many of the old authors, and some very scarce ones; a conservatory almost 300 feet long, full of fine plants, growing and flourishing in the soil (not in pots), like an Indian grove. To this add a garden of four acres, walled round, and full of hardy plants, and all this within 150 yards of the sea."

In a rare tract, attributed to Horne Tooke (who in 1760 was appointed vicar of Brentford), and entitled "The Petition of an Englishman" (1765), there is a view which is described as "A true and accurate plan of some part of Kew Green." On this two houses are marked as in the occupation of Lord Bute. One, "The House in which Lord Bute's family resides," is now part of Cambridge Cottage. The other, "A House built for Lord Bute to study in," is the present Church House. It is very likely that while residing at Kew he kept there his library and dried plants. Between the garden of this house and Kew Gardens there was a door of communication which was the subject at the time of ill-natured suggestion, but probably meant no more than that Lord Bute's books were available for the purposes of the garden.

As a matter of fact this turns out to be more than probable. In the Kew Museums there is a copy of a slightly different version of the same print, from the Political Register, and appended to the descriptive letterpress is the following statement:—

> "In a series of letters some time ago, in the public prints, signed Anti Sejanus, a charge was brought against the favourite, of building palaces, villas, &c. which occasioned an answer from his best informed advocate, in the following words:—
>
> "The only villa that the Earl of Bute hath had within the compass of three years, is a small old house upon Kew Green, with a new detached brick building on one side of the garden, used by him in part for a library, and in part occupied by an under servant of the royal family. *See* a letter signed J. [.], in the 'Public Advertiser,' of Monday, August 26, 1765."

The second initial is lost, but it may be conjectured that the writer was John Haverfield, who was a protegé of Lord Bute's.

Lord Bute has a place in botanical literature as the author of one of the rarest of books. It was entitled "Botanical Tables, containing the "different Familys of British Plants, distinguished by a few obvious "parts of fructification rang'd in a synoptical method." It was in nine volumes, quarto, without place or date. Dryander says:—"Operis "hujus, splendidi magis quam utilis, duodecim tantum exemplaria "impressa sunt." A good deal of information about it will be found in the "Gardeners' Chronicle" for December 20, 1879 (pp. 796–7). Of the twelve copies Lord Bute retained two, and one of these was sold in 1798 for 120*l.* The Kew Library contains an imperfect copy of proofs before letters of the plates.

The artist employed was Johannes Sebastian Mueller, who was born at Nürnburg in 1715. He emigrated to this country and anglicized his name to John Miller. In 1780 he began the publication of a fine series of coloured plates of rare and interesting flowering plants. One of these was *Phormium tenax* (New Zealand flax) probably from a dried specimen. Three others were from specimens flowered at Kew:—*Stuartia virginica*, *Strelitzia Reginæ* (in 1779) and *Lagerstrœmia indica.* The project came to an end with his death in London in 1780.

William Curtis, the founder in 1787 of the Botanical Magazine (which since 1841 has been prepared at Kew), "commenced in 1771 " the 'Flora Londinensis,' a magnificently illustrated folio work, which " almost ruined its author, and was never completed." In 1777 he dedicated the first volume:—

"To the Right Honourable John Stuart Earl of Bute, &c. The Mæcenas of the present Age: This first volume of the Flora Londinensis, Begun under His Auspices, and encouraged by His Liberality, Is, with the sincerest Gratitude, Inscribed by His most obliged, Humble Servant, W. Curtis."

DUKE OF ARGYLE.

In Peter Collinson's manuscripts printed in the Transactions of the Linnean Society (vol. x., p. 275), there is a reference to Lord Bute's share in the works which were carried on at this time:—

> "In the Duke of Argyll's wood stands the largest New England Weymouth pine. This, and his largest cedars of Lebanon now standing, were all raised by him from seed in the year 1725 at his seat at Whitton, near Hounslow.
>
> "This spring, 1762, all the Duke of Argyll's trees and shrubs were removed to the Princess of Wales's garden at Kew, which now excels all others, under the direction of Lord Bute."

The trees were no doubt planted in the old Arboretum, which in part still exists near the Main Gate on Kew Green. Many have perished and have been removed from age. But those that remain include some of the finest specimens of rare trees in the Gardens; in particular, the great Turkey oak near the Temple of the Sun is said to have been planted at this time.

SIR WILLIAM CHAMBERS.

In 1763 Sir William Chambers, the architect of Somerset House, published (as already mentioned) at the expense of the Princess Augusta, a large work entitled "Plans, Elevations, Sections, and Per- " spective Views of the Gardens and Buildings at Kew in Surrey, the " Seat of Her Royal Highness the Princess Dowager of Wales." In the account quoted below (p. 2) it is not very clear whether he is speaking of Kent's work or his own. The Gardens as they exist to-day are the result of the labours of so many hands, as the taste of each successive possessor modified what had been done before, that it is not easy to say whose influence is now most predominant. But judging from contemporary prints the aspect of the Gardens in the middle of the eighteenth century must have been much more formal than it is at present. It recalls more the style which obtained at Versailles and other continental gardens of the time. Gradually it seems to have given way to a less artificial treatment, and to that kind of landscape gardening which is distinctively known as English. This is best suited to the climatic conditions of the country, and Art only interferes to make the most pleasing use of the materials which Nature provides.

> "The gardens of Kew are not very large, nor is their situation by any means advantageous; as it is low and commands no prospects. Originally the ground was one continued dead flat, the soil was in general barren, and without either wood or water. With so many disadvantages it was not easy to produce anything tolerable in gardening; but princely munificence, guided by a director, equally skilled in cultivating the earth and in the polite arts, overcame all difficulties. What was once a desert is now an Eden. The judgment with which art hath been employed to supply the defects of nature, and to cover its deformities, hath very justly gained universal admiration, and reflects uncommon lustre on the refined taste of the noble contriver; as the vast sums which have been expended to bring this arduous undertaking to perfection, do infinite honour to the generosity and benevolence of the illustrious founder, who with so liberal a hand distributes the superfluity of her treasures in works which serve at once to adorn the country, and to nourish its industrious inhabitants."

Since Chambers wrote most of the defects which he pointed out have been remedied, but the barrenness of the sandy and gravelly soil will always remain one of the great obstacles in the successful maintenance of the gardens.

Sir William Chambers erected throughout the grounds a number of fanciful buildings. Many of these were built of fragile materials, and apparently in great haste. Thus (p. 6) he speaks of a bridge thrown over a narrow channel of water. "The design is, in great measure, " taken from one of Palladio's wooden bridges . . . . There is " nothing remarkable in the whole except that it was erected in one " night." The less durable of the buildings, such as the Alhambra, the Mosque, the Gothic Cathedral, &c., have long disappeared. But anyone who is curious about them can see what they were like in the plates of Chambers's book where they are copiously illustrated.

Evans (Richmond, p. 126) speaks of them in 1824:—

> "These buildings, raised by Sir William Chambers about sixty years ago (though others, the aviary, the menagerie, the mosque, &c., have been demolished), are kept in such repair that they possess the freshness of modern erections."

The *Alhambra* stood a little N.E. of the Pagoda. Of the *Mosque* Chambers says (p. 6):—

> "Near the great Pagoda, on a rising ground, backed with thickets, stands the Mosque . . . . It was designed and built by me in the year 1761."

The site was certainly what is called on the Ordnance Map "Moss Hill," a name which probably is a corruption of Mosque.

The buildings that remain may be briefly enumerated, with their respective dates:—The *Orangery* (1761). According to Scheer (p. 35): "The initials of the Princess of Wales . . . . were " affixed in front of the building by William IV., in grateful re- " membrance of Her, who laid the foundation of all the surrounding " scenes." The building is now known as Museum III. (Timbers, &c.); it contains one large room 142 feet by 30 feet, and 25 feet high. The orange trees were removed to Kensington Palace in 1841. The *Temple of the Sun*. Of this Chambers says (p. 3): "Its figure is of " the circular Peripteros kind, but without an Attic; and there is a " particularity in the entablature of which the hint is taken from one " of the temples of Balbeck." The *Temple of Arethusa* (1758) near the Water Tower. The *Temple of Bellona* (1760), stood between the orangery, and the Temple of Æolus. It is evidently identical with the

Temple of Minden, and it must have been removed to the present site of the latter near the Unicorn Gate. Here Evans saw it in 1824 (p. 125).

The true Temple of Minden was the Temple of Victory. This stood in the Pleasure grounds on the hill on which the Flagstaff was afterwards erected. Chambers says (p. 5) :—

> "It was built in commemoration of the signal victory obtained on the first of August 1759, near Minden, by the Allied Army, under Prince Ferdinand of Brunswick, over the French army, commanded by the Marshal de Contades."

The Temple of Æolus was apparently built by Chambers though he gives no date. Sir W. Hooker, in his report for 1845, says :—

> "The decaying Temple of Æolus . . . . has been removed and replaced, under the direction of Mr. Burton, by a very chaste structure of a similar kind, in stone, from the original design of Sir William Chambers."

The *Ruined Arch* (1759), near the Temperate House, "a passage for carriages and cattle over one of the principal walks of the garden."

The *Pagoda* (1761–2); base 49 feet diameter, height 163 feet.

Simpson says (p. 41) :—

> "All the angles of the roofs of the stories were, at the time of building the Pagoda, adorned with large dragons, eighty in number, covered with a kind of thin glass of various colours, which produced a most dazzling reflection, but which have long since been removed."

SMEATON'S ENGINE.

The engine to supply the gardens with water was designed by the celebrated engineer Smeaton, and erected under his direction in 1761. "It answers," says Chambers (p. 4) "perfectly well, raising, by means "of two horses, upwards of 3,600 hogsheads of water in 12 hours." It stood near the present Cumberland Gate, and was in use at least till 1850.

There was no material alteration in the grounds as laid out by the Princess Augusta till the present century, and John Smith, who was employed at Kew 1820, before it became a public institution, when he was appointed the first Curator, gives ("Records," p. v) the following account of the portion dedicated to scientific purposes :—

> "The space allotted consisted originally of nine acres, enclosed by walls (the ornamental building now standing, called the Temple of the Sun, being then nearly the centre of the garden), which was laid out and scientifically planted in two divisions, one containing a collection of herbaceous plants, arranged according to the Linnean system, then in its infancy, but with which Aiton had become well acquainted while serving under Miller. This division was called the Physic Garden."
>
> "The second division was called the Arboretum, containing all the then known introduced hardy trees and shrubs, scientifically arranged. Within the area were several glass houses."

SIR JOHN HILL.

Sir John Hill, a prolific writer on gardening and botany, took much interest in Kew, and in 1758 (second ed., 1759) published an octavo volume of 458 pages, entitled *Hortus Kewensis;* being a Catalogue of the Plants Cultivated in the Garden of H.R.H. the Dowager Princess of Wales at Kew. John Smith writes: "In this catalogue 3,400 "species are enumerated under their Linnean names; of that number "488 consist of hardy trees and shrubs, and 200 shrubby tender "plants."

In his book on the construction of timber (1770) Sir John Hill (p. 33) speaks of Kew as "that garden where every tree that has been seen in Europe is at hand."

In 1772 the Princess Augusta died. George III. eventually bought the freehold of Kew House and grounds from the Dowager Countess of Essex. He maintained the botanical character of the establishment with even greater energy than his mother. Lord Bute disappeared in the affairs of Kew, and the place of botanical adviser which he had filled in the lifetime of the Princess Augusta was now taken by Sir Joseph Banks, who was virtually through the greater part of his life Director of the Gardens. Meantime Aiton had become Superintendent. Thornton published (1799) a graceful portrait of Hill with a view of Kew House. He styles him "First Superintendent of the Royal Gardens at Kew." But there seems to be no evidence of his ever having occupied such a position.

FRANCIS MASSON.

In 1772 the practice was commenced of sending out collectors. In the Banksian Correspondence at the British Museum there is a Memorandum (without date) addressed to the King by Sir Joseph Banks in his capacity as President of the Royal Society, from which the following paragraphs are extracted :—

> "In the year 1772 Sir John Pringle, late President of the Royal Society, made application to His Majesty that Mr. Masson, then one of the under gardeners at Kew, might be appointed to reside for some time at the Cape of Good Hope, in order to collect there seeds and living plants for the Royal Botanical Garden at Kew. His Majesty being graceously pleased to honour this plan with his Royal approbation, and to signify to Sir John Pringle that Mr. Masson would be allowed his expenses, provided that they did not exceed 200*l*. a year, and a recompence on his return of 100*l*. a year, Mr. Masson sail'd for that place, and was absent from England about 3 years [1774–6].

* * * * * *

> "In the course of this voyage Mr. Masson collected and sent home a profusion of plants unknown till that time to the Botanical Gardens in Europe, a full account of which will appear in Mr. Aiton's Catalogue of the Plants in the Royal Botanical Garden at Kew, which is nearly ready for publication; by means of these, Kew Garden has in great measure attained to that acknowledg'd superiority which it now holds over every similar establishment in Europe; some of which at Trianon, Paris, Upsala, &c. till lately vyed with each other for pre-eminence, without admitting even a competition from any English garden."

Francis Masson was born at Aberdeen in 1741. He was the first and one of the most able and successful of the numerous gardeners sent out from Kew to collect living plants for the garden. From the Cape he sent home a very large number of living plants, amounting, according to a letter from him to Linnæus, to 400 species, including new genera.

Sir James Smith, writing in Rees's Cyclopædia :—

> "well recollects the pleasure which the novel sight of an African geranium in Yorkshire and Norfolk gave him about forty years ago. Now, every garden and cottage window is filled with numerous species of that beautiful tribe, and every greenhouse glows with the innumerable bulbous plants and splendid heaths of the Cape. For all these we are principally indebted to Mr. Masson; besides a multitude of rarities, more difficult of preservation or propagation, confined to the more curious collections."

One of the most interesting of these was the plant formerly known as *Encephalartos Caffer* (E. longifolius). This was introduced by Masson in 1775. "In 1819 it produced a male cone, which, being " considered remarkable, led Sir Joseph Banks to come and see it, such " being his last visit to the garden." (Smith, Records, p. 132.) The plant still exists in the Palm-house.

Masson died in North America. Mr. James Lee writes from Hammersmith, March 11, 1806, to Sir James Smith (Memoir, vol. ii., p. 117) :—

> "We are sorry to have to communicate to you the death of our dear friend Masson, who died at Montreal in January last. We lament his fate most sincerely. He was hardly dealt by, in being exposed to the bitter cold of Canada in the decline of life, after twenty-five years' service in a hot climate,—and all for a pittance. He has done much for botany and science, and deserves to have some lasting memorial given of his extreme modesty, good temper, generosity, and usefulness."

Lee returns to the same subject, July 9, 1812 (Smith, Memoir, ii., p. 183) :—

> "I mentioned to you that I thought he had been ill paid, considering what he had done for the science of botany. He explored the Cape of Good Hope twice, Madeira, the Canaries, Azores, Spain, Gibraltar, Tangier, Minorca, Majorca, the West Indies, and Canada. Masson was of a mild temper, persevering in his pursuits even to a great enthusiasm, of great industry, which his specimens and drawings of fish, animals, insects, plants, and views of the countries he passed through, evince; and though he passed a solitary life in distant countries from society, his love of natural history never forsook him. Characters like him seem, for the present, dwindling in the world, but I trust they will revive."

He made his second voyage to the Cape, whence he again sent numerous plants to Kew from 1786 to 1795, between the time of his visit to the West Indies and North America. In 1796 he published a folio volume of coloured figures and descriptions of the *Stapeliæ* of South Africa.

L'HERITIER.

L'heritier de Brutelle, a French botanist, came to England in 1786–7, and studied the Kew collections, which appear to have been freely placed at his disposal. He published in 1788, in Paris, a large folio with 34 plates. He brought over Redouté, the celebrated French botanical artist, to make the drawings. The title of the book is " Sertum Anglicum, seu plantæ rariores, quæ in hortis juxta Londinum " imprimis in horto regio Kewensi excoluntur."

In the preface he says :—

> "Indefesso quindecim mensium labore, plantas delineandas curavi in suo genere pretiosissimas, non sine magnâ hortorum admiratione, qui et affluenti plantarum copiâ et industriâ colendi, famâ guadent non immeritâ."

He describes many of Masson's introductions. Amongst these may be mentioned, *Cineraria cruenta*, the parent of our garden Cinerarias; the singular Elephant's Foot (*Tamus Elephantipes*); and the well-known Cape bulb, *Eucomis punctata*. He also first figures and describes *Chloranthus inconspicuus*. He mentions its reputed use in China for scenting tea, but evidently does not believe it, and remarks "omnino inodorus est." L'heritier was assassinated in Paris in 1800.

WILLIAM COBBETT.

William Cobbett was at one time (about 1773) employed as a gardener at Kew. He tells us :—

> "At eleven years of age my employment was clipping of box-edges and weeding beds of flowers in the garden of the Bishop of Winchester, at the Castle of Farnham, my native town. I had always been fond of beautiful gardens; and a

gardener who had just come from the King's Gardens, at Kew, gave me such a description of them as made me instantly resolve to work in these gardens The next morning, without saying a word to anyone, off I set with no clothes, except those above my back, and with thirteen half-pence in my pocket. I found I must go to Richmond, and I accordingly went on from place to place inquiring my way thither."

* * * * * *

"The singularity of my dress, the simplicity of my manner, my confidence and lively air, and doubtless his own compassion besides, induced the gardener, who was a Scotsman, to give me victuals, find me lodging, and set me to work. And it was during this period that I was at Kew that the present King (William IV.) laughed at the oddness of my dress, while I was sweeping the grass-plot round the foot of the Pagoda."

David Nelson.

In the latter part of the century, the Kew collectors follow one another in pretty rapid succession. Another gardener, David Nelson, was assistant botanist on Cook's third voyage (1776–1779). Subsequently he went with Captain Bligh in the "Bounty" on the voyage to the South Seas for the purpose of introducing the bread-fruit tree into the West Indies. He was among those set adrift by the mutinous crew and died from the long exposure, after reaching Timor in 1789.

Nelson had as an assistant William Brown, described as a "gardiner." They were both "skilful and careful men . . . appointed at Sir "Joseph Bank's recommendation." But while Nelson stuck to Bligh, Brown remained with the mutineers. His history is otherwise unknown.

Bligh states that the expedition was undertaken from

"the King having been graciously pleased to comply with a request from the merchants and planters interested in His Majesty's West Indian possessions, that the bread-fruit tree might be introduced into those islands."

On arriving at Timor (Voyage, p. 239) :—

"I requested in one of my first visits to the Governor, that Nelson might have permission to walk about the country in search of plants, which was readily granted, with an offer of whatever assistance I should think necessary, and the Governor assured me that the country was well worth examination, as it abounded with many curious and medicinal plants. From this indulgence I derived no benefit; for Nelson, who since we left New Holland, had been but of a weak condition, about this time was taken ill, in consequence of a cold caused by imprudently leaving off warm clothing."

L'heritier founded the famous genus *Eucalyptus* on *E. obliqua* a species which he figured in the "Sertum Anglicum," and which had been found by Nelson in Van Dieman's Land. It was first introduced, however, into cultivation by Capt. Furneaux in 1774, who commanded the "Adventure" in Cook's second voyage.

Anthony Pantaleon Hove, M.D., a Pole, was employed by Sir Joseph Banks and Kew to collect plants in India, 1787–9.

Flowering of Orchids.

John Smith (Records, p. 228) quotes Sir James Smith :—

"We have scarcely seen any one species of this genus [*Epidendrum*], except in a dry state, before the year 1787, when *E. cochleatum* flowered at Kew, nor was it till October 1788, that *E. fragrans* of Swartz exhibits its fragrant and elegant bloom in the same rich collection. At present, several species are to be seen flowering in the spring and autumn."

COOK'S VOYAGES.

Smith (Records, p. 9) says:—

> "It was generally understood that the first New Holland plants introduced to this country were due to the voyages of Captain Cook, between the years 1768 and 1780, but, according to Aiton's 'Hortus Kewensis,' 1813, and an 'Addenda,' 1814, I find only two plants introduced during the period of these voyages, *Casuarina torulosa* and *C. stricta,* the first in 1771, the second 1775, both of which were accredited to Sir Joseph Banks (then Mr. Banks), who with Dr. Solander, was attached to Cook's voyage as naturalist."

The object of the first voyage was to observe the Transit of Venus in 1769 in the South Pacific.

Erasmus Darwin probably had Cook's voyage in mind in writing the rather turgid lines which are to be found in the fourth canto of the "Botanic Garden" published in 1791.

So sits enthron'd in vegetable pride,
Imperial Kew by Thames' Glittering side,
Obedient sails from realms unfurrow'd bring,
For her the unnam'd progeny of Spring,

* * * * * *

Delighted Thames through tropic umbrage glides,
And flowers Antarctic bending o'er his tides.

The New Zealand flax (*Phormium tenax*) was introduced in 1789.

Smith has perhaps underrated the horticultural results of Cook's voyages. A more critical examination of the Hortus Kewensis would probably considerably enlarge the list. In Salisbury's Paradisus Londinensis (t. xv.) Capt. Furneaux, who commanded the "Adventure" is credited with the first *Eucalyptus* (*E. obliqua*), *Sideroxylon sericeum* and *Leptospermum lanigerum.*

THE ELDER AITON.

In 1789, Aiton published his "Hortus Kewensis"; or a catalogue of the plants cultivated in the Royal Botanic Gardens at Kew.

He describes himself as "Gardener to His Majesty," to whom he dedicates "this attempt to make public the present state of the Royal "Botanic Garden at Kew." He continues:—

> "Small as the book appears, the composition of it has cost him a large portion of the leisure allowed by the daily duties of his station during more than sixteen years; in all that time it has been thought worthy the assistance of men more learned than himself."

According to Scheer (p. 19) these were the Earl of Bute, Sir Joseph Banks, Dr. Solander, and Dryander, who was Banks librarian. John Smith (p. vi), says:

> "In this work 5,500 species are described and classified according to the Linnean system with the native country of each species, date of introduction, and by whom introduced."

The few facts of William Aiton's biography may be recorded; they are taken from a letter preserved in the Kew Library:—

> "He was born at Hamilton, in Lanarkshire, in 1731. He came to England in 1754, and was employed at Chelsea. In 1759 he was engaged to superintend the Botanical Gardens at Kew. In 1764 he became acquainted with Sir Joseph Banks. In 1783 he had charge of the pleasure and kitchen gardens at Kew. In 1789 he published his Hortus Kewensis. He died on February 2nd, 1793, in his 63rd year."

The Marchioness of Rockingham writes to Sir James Smith (Memoir, vol. ii., p. 58), from Hillingdon House, March 3, 1793:—

"I little thought five years ago that I could have felt so much concern for the death of Mr. Aiton; but I had not seen him then, and only looked upon him as the Kew gardener; but the single quarter of an hour that he was with me occasioned an instantaneous conversion. I was quite charmed with the plainness of his manners, without a grain of that pomposity one might have expected; but on the contrary, quite pleasant and communicative in his profession; in short, he took my fancy so much that I cannot help feeling infinite regret that so great and good a man in his line should now be no more."

He must have been held in no small esteem. He is buried at Kew, and amongst those who bore his pall in testimony, Simpson says (p. 72), to his "professional abilities and private worth," was Sir Joseph Banks, the Rev. Dr. Goodenough (afterwards Bishop of Carlisle), Dr. Dryander, and Zoffany the artist.

His funeral sermon was preached at Brentford by the Rev. W. Smith, February 17 following. The sermon was printed, and Aiton is described as "His Majesty's Principal Gardener at Kew." The following passage (p. 23) at any rate shows that his reputation was not unknown in foreign countries:—

"Not only was our friend universally known and esteemed in his own country, but his name and fame have extended to distant kingdoms, and to every quarter of the globe. I myself have found them passports in various places abroad, and through his recommendation alone have been introduced to men of genius and science, even in foreign courts."

ARCHIBALD MENZIES.

"Captain Vancouver," says Smith (Records, p. 9), "in his voyage of survey "(between 1791 and 1795), was accompanied by Archibald Menzies as [botanist "and] surgeon. The ship touching at King George's Sound, on the south-west "coast of Australia, Menzies made a rich collection of herbarium specimens and "seeds, and was the first to transmit cones of *Banksia* and other *Proteaceæ* to Kew "from that part of New Holland."

Menzies introduced the now well-known *Araucaria imbricata.* Smith (Records, p. 287) tells the story:—

"At a dinner given by the Viceroy of Chili to the captain and officers of the ship part of the dessert consisted of nuts which Menzies (who was a good botanist) had not before seen. Instead of eating all his share, he took some with him on board, and having obtained a box of earth, planted them, when they sprouted, and he succeeded in bringing five plants to England, which were safely received at Kew. . . . . . In 1833 King William IV. presented one to Lady Granville for her collection at Dropmore. It was then about 5 ft. high, growing in a tub; it is now (1880) a fine tree 60 feet high; this is, however, much inferior to another plant at Dropmore, said to be the produce of a cutting stolen by a lady from the original plant at Kew nearly fifty years ago."

According to Loudon (Arboretum, vol. iv., pp. 2435–6)—

"Menzies . . . . . brought home living plants, which he presented to Sir Joseph Banks, who planted one of them in his own garden at Spring Grove, and sent the others to Kew. From this circumstance, the tree was called at first in England Sir Joseph Banks's pine. The tree at Kew was kept in the greenhouse till 1806 or 1808, when it was planted out where it now stands, by Mr. McNab, the present (1838) superintendent of the Edinburgh Botanic Garden. After it was planted out, not being considered quite hardy, it was protected during winter with a temporary frame, covered with mats; and having become habituated to this mode of treatment, it has been considered unsafe to leave it off."

The unfortunate tree seems always to have had a bad time. Neill, writing in 1817 (Horticultural Tour, p. 77), says:—

"The most magnificent specimen of Chili pine (*Araucaria imbricata*) at Kew Gardens was irretrievably injured by its presence at a single gala at Carlton House, owing to the servants having very imprudently attached lamps to the branches of the tree."

Scheer writing in 1840 (pp. 41, 42) refers to the original specimen of *Araucaria imbricata.*

> "Still the lion of the gardens, King William, who, in his frequent visits to Kew, never omitted going over the Botanic Gardens, and latterly, when walking became inconvenient, drove through them in a pony phaeton, and at all events looked into every house, delighted to point out this superb tree to such strangers as might be with him."

It is anything but "a superb tree" now, and only lingers on as a historic curiosity.

Menzies was also the discoverer (1796) of *Sequoia sempervirens*, the redwood of California.

The following particulars are taken from his epitaph. He was a navy surgeon, and served in the fleet commanded by Admiral Rodney, April 12, 1782. He twice circumnavigated the globe, first with Captain Colnett and afterwards with Captain Vancouver. He afterwards practised his profession in London, and died at Notting Hill, February 15, 1842, aged 88 years.

It is remarkable that Vancouver himself is buried at Petersham, a parish with which Kew was long ecclesiastically united.

Rodney's squadron had another point of contact with botany. Bryan Edwards ("History of the West Indies," vol. i., p. 477), says:—

> "This plant [the Mango], with several others, as well as different kinds of seeds, was found on board a French ship (bound from the Isle de France for Hispaniola) taken by Capt. Marshall, of His Majesty's ship 'Flora,' one of Lord Rodney's squadron, in June 1782, and sent as a prize to this island [Jamaica]. By Capt. Marshall, with Lord Rodney's approbation, the whole collection was deposited in Mr. East's Garden [at Liguanea], where they have been cultivated with great assiduity and success."

CHISTOPHER SMITH.

Christopher Smith took the place of David Nelson and went with Bligh on his second and successful voyage, 1791. In 1793, Captain Bligh brought home in the "Providence" a large collection of living West Indian plants made by Smith, but recorded as introduced by the former in the "Hortus Kewensis." Smith was afterwards appointed botanist to the East India Company, and he prepared a large collection of living plants at Calcutta for Kew.

In 1797 he visited the Moluccas, where he made a large collection of plants, especially herbarium specimens. In 1805–6 he was at Penang, where he died.

JAMES WILES.

Christopher Smith was accompanied on Bligh's voyage by James Wiles, who had been in the employ of R. A. Salisbury, the botanist, and who was to take charge of the plants on their arrival in the West Indies. Three hundred young Bread-fruit trees were landed at Jamaica in February 1793, and placed in the Botanic Garden at Liguanea (9 miles from Kingston) under his care.

From the "Handbook of Jamaica, 1890–1" (pp. 158–9), it appears that the Liguanea Garden (Gordon Town) had been formed by Mr. Hinton East.

> "Mr. Bryan Edwards, in the 'History of the British West Indies,' remarks, that the Assembly of Jamaica, co-operating with the benevolent intentions of His

Majesty (to introduce valuable exotics and productions of the most distant regions to the West Indies) purchased in 1792-3 the magnificent Botanical Garden of Mr. East, and placed it on the public establishment, under the care of skilful gardeners, one of whom, Mr. James Wiles, had circumnavigated the globe with Captain Bligh."

In the Kew library there is a volume of Bank's correspondence, which contains some interesting letters relating to the transaction.

R. A. Salisbury writes, 17th March 1793, acknowledging a fine collection of East Indian seeds. He concludes :—

"I have a long letter from Wiles written in great health and spirits, and most heartily congratulate you on the grand object he went for being so nearly and no doubt by this time accomplished."

Wiles writes to Banks :—

"Bath, Jamaica,
"16th October 1793.

"The Committee appointed for the bread fruit and other plants, informed me they intended sending you an account of the progress and increase of the trees, but I believe they have neglected it.

"I have, Sir, the pleasure of seeing not only all the plants immediately under my own care, but likewise all those distributed over the whole parish of St. Thomas in the East thriving with astonishing vigor; but I am sorry to hear several are dead in some of the parishes to leeward. * * * *

"I hope the House of Assembly will purchase a piece of ground for a new nursery, as the present one labours under many great disadvantages."

Six years later he writes :—

"Botanic Garden, Liguanea, Jamaica,
"12th April 1799.

"The Committee for superintending the Public Botanic Gardens, ... recommended to the House of Assembly a vote of thanks to you for your kind intention of supplying Jamaica with the spice plants of the East, particularly the Nutmeg. * * * *

"The bread fruit tree is so easily propagated by suckers that it is now become very common over the whole island, indeed all the south sea plants have succeeded remarkably well here.

"I have the pleasure to observe the taste for plants daily increase in this island; several gentlemen are now forming gardens on a liberal scale."

Two years later he writes from the same address:—

"16th May 1801.

"I know not whether the Committee superintending our botanic gardens have written to you for a botanist to take charge of them or not, I rather think none of the members will give themselves that trouble; however, Sir, should they make the application and you comply with it, I shall esteem it my duty to give the gentleman you may recommend my best advice and assistance at all times, although I cannot help repeating here what I mentioned in my last letter—that my successor will, I fear, meet with much chagrin and disappointment.

"The bread fruit tree is now perfectly naturalized in Jamaica, indeed all the south sea plants have been propagated abundantly. * * * *

"We wish very much for plants of the Nutmeg and true Mangosteen. I have received clove plants twice from St. Domingo, but they died away notwithstanding I paid the utmost attention to their culture."

Wiles appears to have still remained in charge of the Gardens in 1805, but his further history is unknown. In 1810 the Liguanea Garden was sold by the House of Assembly.

PETER GOOD.

Peter Good, a Kew gardener, was sent to Calcutta in 1796 to bring home the collection prepared by Christopher Smith. On his return he remained at Kew as foreman till 1801, when he was appointed assistant to Robert Brown, the botanist attached to Flinders's voyage of survey of the coast of Australia. Kew was largely indebted to him for the fine collection of *Proteaceæ* it formerly possessed. In the early part of their voyage they touched at King George's Sound, where large collections were made. They then surveyed the whole of the south coast of New Holland, passing through Bass's Straits to Port Jackson, where shortly after Good caught fever, and died at Sydney in June 1803. His collection of seeds, however, was forwarded to Kew.

FRANCIS BAUER.

A striking picture of the activity and energy which were employed in augmenting the Kew collections in the eighteenth century, is afforded by the younger Aiton's preface to Francis Bauer's "Delineations of Exotic Plants cultivated in the Royal Gardens at Kew" published in 1796. Bauer was an Austrian, who, coming to England in 1788, was, by the liberality of Sir Joseph Banks, and with the King's sanction, attached as draughtsman to the Botanic Garden. Banks not merely paid his salary during his own life, but provided for its continuance after his death.

> "A variety of circumstances have concurred, since the publication of the *Hortus Kewensis*, by which the number of curious plants, cultivated in the Royal Gardens at Kew, have received material increase; Mr. Masson, who has travelled as a botanist, at His Majesty's expense, for twenty-five years, was never so fortunate in furnishing abundance of fresh seeds and living plants as during his last mission to the Cape of Good Hope. The settlement of a colony on the coast of New South Wales has opened to us a fresh source of botanical wealth, in a climate nearly congenial to our own; and of this a large share has been transmitted to Kew, by Arthur Philip, Esq., the Governor. William Bligh, Esq., Commander of H.M.S. 'Providence,' who was sent to the South Seas for the purpose of carrying the bread-fruit from thence to the British Colonies in the West Indies, and had orders to replace such of the useful plants as might die during the passage or be deposited in the places of their destination, by such curious plants as the gardeners attending the expedition could procure, has also been enabled to place in Kew Gardens some hundreds of species, natives of the East or of the West Indies, which had never before been seen in Europe.
>
> "No events, however, have so materially tended to the increase of the Royal collection as that decided preference which our most gracious Queen has of late condescended to bestow upon the science of botany, and the rapid progress Her Majesty, and the Princesses, her daughters, have made in the most difficult parts of that pleasing study; the nobility and gentry of England have since this was known, more than ever attached themselves to a pursuit honoured by the interesting patronage of their beloved Queen; individuals have vied with each other in presenting to Kew Gardens such plants as they thought likely to make an acceptable addition to the collection; commanders of ships have employed the leisure of their homeward bound passages in taking care of the vegetable produce of the climates they had visited, anxious to furnish on their return any degree of increase to Her Majesty's amusements. The Directors of the East India and of the Sierra Leone Companies [Afzelius was botanist to the latter Company in 1794] have forwarded to Kew such plants as their servants abroad were able to procure for them; and the Government of Jamaica has sent a public present to Her Majesty, of plants collected in that island.
>
> "Amidst the uniform protection which the Royal owner of these gardens has constantly afforded to every species of science, Botany had not a right to expect more than its proportional share; the increase of conveniences of every kind in Kew Garden has, however, by His Majesty's royal favour, kept equal pace with the increase of plants; new houses have been built, upon a most ample scale, and of a most convenient construction; the garden itself has lately received a considerable addition of space; and the whole has been laid out, under His Majesty's immediate direction, in a manner so commodious, that it is not only capable of containing the whole of the present Collection with ease, but of receiving all such additions as may probably be made to it for several years to come."

Bauer's history is concisely given in the epitaph on his monument in Kew Church.

> In memory of Francis Bauer, Esq., F.R.S., F.L.S., &c., Botanical Painter to His Majesty George III. and resident Draughtsman for fifty years to the Royal Botanic Garden at Kew, where he devoted himself to the advancement of natural science; under the munificent patronage of Sir Joseph Banks, Bart., the President of the Royal Society. In the delineation of plants he united the accuracy of a profound naturalist, with the skill of the accomplished artist, to a degree which has been only equalled by his brother Ferdinand. In microscopical drawing he was altogether unrivalled, and science will be ever indebted for his elaborate illustrations of animal and vegetable structures, of which invaluable specimens are preserved in the British Museum and in the University of Gottingen. He was born at Felsperg in Austria, on the 4th of October 1758 and accompanied his friend the Baron Joseph Jacquin to England in 1788. He settled at Kew in 1790, where he lived admired, loved, and respected. He died on the 11th of December 1840, aged 82 years. The *works* of Francis Bauer are his best *monument*. Friendship inscribes this record on his honored tomb.

NIÉPCE.

The following extract from Scheer (p. 51), though unconnected with botany, is sufficiently interesting to deserve quotation:—

> "It is somewhat remarkable that Niépce, the original discoverer of what is called the Daguerrotype, resided about the year 1827 in Kew, and induced Mr. Bauer to submit his discoveries to the Royal Society; which, however, took but little notice of them. Niépce returned to France, but left a brother at Kew, who died shortly afterwards, and was buried in our churchyard. Some of the earliest specimens of Niépce's art are now in the possession of Mr. Bauer, and there are others to be met with at Richmond."

GEORGE CALEY.

Smith (Records, p. 10) says:—

> "The next special collector was George Caley, who in 1801 was appointed by Sir Joseph Banks as botanical collector in New South Wales for Kew. He remained about ten years in the Colony, botanising chiefly in the country about Sydney and the Blue Mountains, and a considerable number of plants have been introduced by him."

Among these was the *Livistona australis*, which was long one of the most striking ornaments of the Palm House. It was taken down in 1876.

Born in Yorkshire, he is said to have begun life as a stable boy, and afterwards to have been a horse doctor near Birmingham. He became interested in the study of plants from collecting them for his horse medicines. His enthusiasm attracted the attention of Sir Joseph Banks and induced the latter to send him as collector to Australia. In 1803 plants from him reached Kew. In 1811 he was at Rio on his way back. He was Superintendent of the Botanical Garden, St. Vincent, from 1816–22. Brown describes him as "Botanicus peritus et accuratus." He died at Bayswater, 23rd May 1829 and is buried in the old burying ground of St. George's.

The Rev. Lansdown Guilding in his "Account of the Botanical Garden," pp. 22, 23, says:—

> "In 1821, the Government, ... determined on giving up the garden, which for many years had been maintained at a great expense to the mother country, exceeding even of late the yearly sum of 700*l*. sterling. This step did not fail to cause great surprise. The nutmeg and other valuable spices had arrived at maturity; the cloves were producing annually a million of seed, and the garden, which had hitherto been comparatively of little use, was about to realise the hopes that had been entertained by its Royal patron."

WILLIAM KER.

In 1803 William Ker, a gardener, was sent to collect in China. He also visited Java and the Philippines. He sent home various living plants and first introduced *Cunninghamia sinensis*, *Lilium tigrinum*, and *L. japonicum*. *Kerria japonica* was named after him. In 1812 he became Superintendent of the Royal Botanic Garden, Ceylon.

In the following year he visited Adam's Peak, on which he discovered many new plants. He died in Ceylon in 1814 and was succeeded as superintendent by Alexander Moon.

The latter was a native of Scotland. He was at Kew in 1815. He sailed for Ceylon in 1816, and on the voyage out had the opportunity of landing at Gibraltar and the Barbary Coast from whence he sent plants. He arrived in Ceylon in 1817 and the following year sent plants to Kew. He died in 1825.

THE YOUNGER AITON.

William Aiton had been succeeded at Kew by his son William Townsend Aiton. John Smith (pp. vi and vii) may be again quoted:—

> "Assisted by Dr. Dryander, librarian to Sir Joseph Banks, and afterwards by Mr. R. Brown, he in 1813 published a second edition of his father's works in five volumes, and in 1814 a catalogue or epitome as it is called of the species contained in the five volumes, for the use of practical gardeners; it contains . 314 additional species, the total number being 11,013.
>
> "Through the patronage of Sir Joseph Banks, and the labours of public and private collectors, the collection continued to increase, which led Mr. Aiton to prepare a second edition of the epitome, and for their future identification he had about 2,000 drawings made. In 1830 the manuscript of the new epitome was ready for printing, but consequent on the alteration in the management of the Royal Gardens made by William IV., it was postponed, and on Mr. Aiton's resigning in 1841 it was not again heard of, and at his death in 1849 it is believed to have shared the fate of being burned with all his immense correspondence and the early records of the Garden."

In a letter published in "The Garden" (Jan. 24, 1880, p. 75) it is stated by Mr. Smith that "the drawings and plant record books were, however, spared."

To further quote from this letter:—

> "Mr. Aiton, in 1822, began to have drawings made of the new and unfigured plants then in the garden. His first artist was Thomas Duncanson (a young gardener from the Royal Botanic Garden, Edinburgh), who had a talent for drawing plants; and Mr. Aiton finding him qualified to draw the plants sufficiently accurate for them to be identified, in time he was entirely occupied in drawing, which he continued to do until the summer of 1826, when he unfortunately became insane * * * He was succeeded by George Bond, then a young gardener at Kew, who was employed in drawing for nine years, when, in 1835, he became gardener to the Earl of Powis, at Walcot, where he now is. * * * The number of subjects drawn by these two artists amount to about 2,000, of which about 1,700 were drawn by Mr. Bond. * * * On Mr. Aiton's retirement in 1841, his garden library, record plant books, papers, and drawings were removed to his own house, and on his death in 1849, the whole of his immense correspondence was burnt by his brother, John Aiton. * * * Some time after John Aiton's death, Mr. Attwell Smith, Mr. Aiton's heir, was pleased to return them (the drawings and plant record books) directed to the care of Sir W. Hooker."

The drawings are incorporated with the immense collection of botanical drawings and prints preserved in the Kew Library. The rescue of the record books is due to Mr. Smith. In the "Journal of Botany," for 1884 (p. 127), he states "after John Aiton's death, on "my inquiring after them, they were restored to the gardens by a

"Mr. Smith, a natural son of John Aiton's, who became his heir." The books range from 1793 to 1847, that for 1825–36 being wanting.

In the dedication to the King the younger Aiton describes his edition of the *Hortus Kewensis* as :—

"A work rendered necessary to the public, not only by the number of plants continually sent home by your Majesty's collectors abroad, but also by the extensive influx of curious exotics poured into it of late by your Majesty's subjects, anxious to aid, by their individual exertions, that munificent patronage which has rendered botany a favourite pursuit among all the classes of your Majesty's people."

The following paragraph also deserves quoting as showing how very varied were the King's intelligent tastes :—

"Among the trusts confided by your Majesty's gracious goodness to the superintendence and direction of your devoted servant, the Botanic Garden is not the only one that receives the heartfelt gratitude of an enlightened nation; the grassy lawns of the Royal Pleasure Grounds exhibit a still more interesting spectacle : it is there, where your Majesty has, by a degree of foresight, of judgment, and of patience, which are seldom united in one character, triumphed over the prejudices of your subjects, and, in defiance of ancient and deeply rooted opinions, established, by your Majesty's own efforts, what for ages past has been deemed impossible,—the growth of the superfine wools of Spain in the happy climate of Britain."

SIR JOSEPH BANKS.

The Epitome is dedicated to Sir Joseph Banks "with a deep sense "of his cordial friendship, and in gratitude for his innumerable "donations of the most rare exotics to the Royal Collection of Kew."

Scheer (p. 20) gives some illustrations :

"We should like to see a pictorial representation of the scene of Sir Joseph Banks's introducing the first *Hydrangea hortensis* to Kew about the beginning of 1789 for the inspection of the curious. It had begun to flower in the Custom House, and its green petals were a puzzle to the botanists of the day. The next day he exhibited it at his house in Soho Square, from whence it was removed, and lived in Kew, the parent of its numerous progeny now spread all over Europe, till within these few years. This year also saw the *Pæonia Moutan* introduced from China, and it is in the gardens to this day alive and well, a venerable monument of happier times. The common fuchsia also became then (1788) first known, and we are told that Lee sold small plants at five guineas each."

Smith (Records, p. 268) refers to these plants :—

"We have yet to notice three special plants, namely, *Pæonia Moutan*, *Hydrangea hortensis*, and *Fuchsia coccinea*. The original plants of these occupied a bed of earth in a small lean-to house 12 feet in length and 6 feet in width, with a low roof. In 1820 this erection was in a very dilapidated state, and it was entirely removed. The plants remaining were then protected in winter by a covering of dry fern and mats. In 1842, the site being required for another purpose, they had to be removed after having occupied that spot for 50 years."

The *Fuchsia* was probably not *F. coccinea* a Brazilian species, but *F. magellanica* from Chili.

Simpson (p. 42) speaks of the hydrangeas as still existing in 1849 :—

"In some of the flower beds near [the Temple of the Sun] are descendants of the original *Hydrangea hortensis*, presented to the gardens in 1789 by Sir Joseph Banks, and which began to flower in the Custom House."

Scheer says (p. 60) :—

"It was, we believe, the practice of Sir Joseph Banks to retain rare plants at Kew for one year after they had flowered, and then they were liberally distributed to learned societies and eminent men."

Perhaps from constitutional diffidence Sir Joseph Banks published scarcely anything. No scientific man of his eminence probably ever did so little personally or was the inspiring cause of so much being done by others. In every field of botany cultivated in his day he was indefatigable in his interest. The number of interesting plants which he was at the pains to introduce to cultivation through Kew was no doubt very great. In Aiton's Hortus Kewensis his name is of the most frequent occurrence.

Two notable plants may be singled out. In 1784 he introduced the well-known and splendid "Sacred Bean," *Nelumbium speciosum*. This has always been cultivated since at Kew, and it is not impossible that the plants now grown in the gardens descend from that introduced by Banks.

Another beautiful plant which almost certainly preserves an unbroken descent at Kew is *Strelitzia Reginæ*, which Banks named in honour of Queen Charlotte, who was a daughter of the Duke of Mecklenburg-Strelitz, but which, with characteristic modesty, he allowed Aiton to publish. Another species, *Strelitzia Augusta*, may have been named in compliment to the Princess Augusta, mother of George III.

William Curtis in the third volume of the Botanical Magazine, t. 119, figures *Strelitzia Reginæ*.

> "It is well known to many botanists and others, who have experienced Sir Joseph Banks' well known liberality, that previous to the publication of the *Hortus Kewensis* he made a new genus of this plant, which had before been considered as a species of *Heliconia*, and named it *Strelitzia* in honour of our most gracious Queen Charlotte, coloured engravings of which, executed under his direction, he presented to his particular friends; impressions of the same plate have been given in the aforesaid work, in which we are informed that this plant was introduced to the Royal Garden at Kew, by Sir Joseph Banks, Bart., in the year 1773, where it lately flowered."

He adds:—

> "It has not, that we know of, as yet ripened its seeds in this country; till it does, or good seeds of it shall be imported, it must remain a very scarce and dear plant, as it is found to increase very slowly by its roots. Plants are said to be sold at the Cape for three guineas each."

Francis Bauer published in 1818, a work which is one of the most beautiful productions of his pencil. It is entitled:—

"*Strelitzia depicta*, or coloured figures of the known species of the genus Strelitzia, from the drawings in the Banksian library." This is sometimes erroneously cited under the name of Ker. H. B. Ker was, however, only the lithographer.

Banks's public services in the introduction of plants was not without appreciation at the time. In the Banksian correspondence at Kew is the following letter, which appears to be the dedication of the "Universal Botanist."

> "To JOSEPH BANKS, Esq., Fellow of the Royal Society, &c., &c.
>
> "SIR,
>
> "THE public is highly indebted to you for the indefatigable pains you have taken to improve the science of botany, by introducing into England the vegetable beauties of such remote climates.
>
> "Future ages will revere your name when they see the valuable productions of distant countries naturalised here and in our colonies, which must prove of great advantage to the commerce of these kingdoms.
>
> "Tournefort travelled over the East; Sloane, Jamaica; Ray, Europe; Plumier, America; Adanson, Africa; you, Sir, have surpassed all these, by traversing from pole to pole in search of useful and salutary plants and introducing them into these realms at a very great hazard and expence.
>
> "I am, with great respect,
> "Sir,
> "Your most devoted humble servant,
> RICHARD WESTON.
>
> "King's Road, Chelsea,
> "March 1, 1775."

The following correspondence, which is preserved in the Kew Library, is interesting as illustrating the position and functions which Sir Joseph Banks fulfilled in regard to Kew :—

"W. T. AITON, Esq., to The R^{t} Hon'ble Sir JOSEPH BANKS, Bart., K.B.,
"&c., &c.

"SIR,

"ON all subjects the most interesting to the Royal Collection at Kew you have been pleased to allow me to be directed by your greater experience, I therefore trouble you with this letter.

"I beg I may refer to your recollection that previously to the illness of the King it was His Majesty's pleasure to direct that Botanical Collectors were to be prepared and sent abroad for the express object of procuring fresh and choice supplies of seeds, roots, and plants, become necessary to be added to keep up the Royal Collection of Kew, made superior to other gardens in England by means of the frequent importations of the rarer Exotics; in all cases of this kind the subject has been referred by His Majesty's command for your decision to fix upon and name those countries most proper for botanists to explore.

"The improved state of science in England, the increasing desire of novelty in botanical pursuits, the great deterioration and the loss of various plants, that no ordinary means of care could obviate, and withall the repose of botanists awaiting orders of appointment abroad, together most anxiously beseech your kind view of this subject. I therefore entreat your mediation and support of the necessary and good cause of sending Botanical Collectors to foreign parts in search of supplies.

"On some occasions you have named Southern Africa, America, and the promising lands of New Holland, as ample fields for a productive harvest. You have also visited these countries, and consequently are the best judge of the particular tracts proper for research.

"I have in view men of sound principles and invaluable zeal for the service, having the best requisites of knowledge, and desire to offer themselves as collectors, and who will perform this duty in any part of the world. Under circumstances so favourable, and with it the most supreme blessing of general peace, I think the subject and the season to submit it to Royal approbation auspicious. I therefore humbly beg you will confer upon me the kindness of your directions to govern my proceeding with this business in the way you approve, so that I may not fail in duty to the Royal Garden at Kew when the most favourable opportunity occurs to lay this subject before His Royal Highness the Prince Regent for His Royal Highness's most gracious commands.

"I have the honour to be,
"Sir, &c., &c., &c.
"(Signed) W. T. AITON.

"Royal Gardens, Kew,
"May 29, 1814.
"To the Right Hon^{ble} Sir Joseph Banks,
"Bart., K.B., &c., &c."

"The R^{t} Hon'ble Sir JOSEPH BANKS, Bart., K.B., &c., &c., to W. T. AITON, Esq.

"MY DEAR SIR, Soho Square, June 7th, 1814.

"AMONG the innumerable indulgencies I have for a long time enjoyed, derived from the gracious kindness of our beloved and afflicted Monarch, the connection I have been permitted to form with the Royal Gardens at Kew is among those most grateful to my feelings, and I beg you to be assured that as long as I shall be permitted to continue it I shall cherish and improve it to the best of my power.

"Among the other indulgencies allowed to me on that head, I was permitted, as you, Sir, know, to draw instructions for those persons whom you from time to time recommended as properly qualified to travel as collectors for the Royal Botanic Gardens. I think I may venture to affirm that until that arrangement was interrupted by the almost impossibility of sending home living plants in ships liable to the detention of waiting for convoy, His Majesty's Gardens at Kew stood unrivalled in the whole of Europe for the extent of its collections as well as for the beauty and interest of the plants it consisted of.

"The arrival of the definite treaty with France, and the certainty that before any collection can be ready to be sent home, ships will sail as they were used to do without being subjected to any uncertain delays, makes me anxious to see the establishment of foreign collectors resumed, and the more so as the Emperor of Germany, who has formerly freighted ships at an immense expense, and sent well-educated botanists to collect for his Garden at Schœenbrun (the only rival to Kew that I have any fear about), will no doubt resume the business of improving it.

"The climate best suited for our collectors is, as you know, the southern temperate zone, and in that part of the world no places are so productive as the Cape of Good Hope and New South Wales: if His Royal Highness the Prince Regent should permit you to engage two collectors these are the places I should wish them to be sent to. The plants of both these countries are beautiful in the extreme, and are easily managed, as they suit the conservatory and have no occasion for the unnatural heat required by the intertropical vegetable. I should wish also to have a collector sent to Bueonos Ayres, but at present, and till Spain has repossessed herself of her refractory Colonies, this cannot be thought of.

"Should you be allowed to send to the Cape of Good Hope and to New South Wales, I have no doubt of being able to give such instructions to the governors of these countries as will enable His Majesty's collectors to visit at a very reasonable expense countries hitherto unexplored, and they will add to the royal collection riches beyond the most sanguine expectations of those who have had less experience in the produce of those countries than has fallen to my lot.

"I am,
"My dear Sir,
"With real esteem and regard,
"Your most faithful and most obedient servant,
"(Signed) Joseph Banks."

"To W. T. Aiton, Esq.,
"Royal Gardens, Kew.

"Treasury to the R^t Hon'ble Sir Joseph Banks, Bart., K.B., &c., &c.

"Sir, Treasury Chambers, September 13, 1814.

"Having laid before the Lords Commissioners of His Majesty's Treasury the communication which you were so good as to make to me, by the desire of the Earl of Liverpool, upon the subject of the appointment of fit and proper persons to proceed to the Cape of Good Hope and elsewhere, for the purpose of collecting rare and curious plants for His Majesty's Botanic Garden at Kew, I have received their Lordships commands to express to you their entire concurrence in the suggestions contained in that communication, and their approbation of the persons recommended by you for this service, and that their Lordships will nominate them thereto accordingly, and that their Lordships feel much gratified by, and will most readily adopt your offer of auditing the accounts sent home by the collectors, and of certifying them to the Treasury, when sent home for their Lordships' approbation. And I am further to acquaint you that their Lordships' will from time to time issue to Mr. Aiton, the Superintendent of His Majesty's Botanic Garden at Kew, such sums as you may recommend for this service, for the application of which Mr. Aiton will be accountable only to their Lordships' Board. And that with a view to provide for such outfit of the persons appointed on this service as may be necessary, their Lordships have directed Mr. Spur of this office to issue to Mr. Aiton the sum of 200*l*. upon his application for the same.

"And my Lords have further commanded me to request that you will have the goodness to give either immediately from yourself or through Mr. Aiton, as you may deem most expedient, such instructions to the collectors for their governance and conduct in the discharge of their duties as may appear to you best calculated to ensure a due and faithful execution of the service entrusted to them, and such a satisfactory result as may reasonably be expected from their employment in it, which instructions their Lordships have directed them most implicitly and punctually to observe and obey.

"Conformably to your suggestions with regard to the passage of these persons to the first objects of their destination, my Lords have requested the Lords of the Admiralty to direct that they may be provided with a passage in the first Man of War which may sail for Rio de Janeiro, and that they may be entered on the ships books for provisions, and be allowed to mess with the warrant officer, and that they will direct the officer commanding His Majesty's Naval Forces at Rio de Janeiro to give any similar facilities which may occur for their transport to the Cape of Good Hope.

My Lords have also requested the Earl Bathurst to direct the Governor of the Cape of Good Hope to provide for the Service of the Collectors a Waggon, a couple of Teams of Oxen for their Journies, a Hottentot Driver and two or three more to attend the oxen, and also to furnish the Collectors with the usual order upon the boors for boorspans of Oxen, and if they should go beyond the limits of the Colony, with an order to the Landrost to give them the protection of a few boors, which is termed a Commando.

"I have the honour to be,
Sir,
"Your very faithful and obedient
Servant
"(Signed) Geo. Harrison.

"The Right Hon^{ble}
"Sir Joseph Banks, Bart., K.B.
"&c &c &c"

Allan Cunningham.

Allan and Richard Cunningham were the sons of Allan Cunningham, a native of Renfrewshire. They were born at Wimbledon, the first in 1791, the second in 1793. Allan was placed in a conveyancer's office. His engagement by Aiton to assist in the preparation of the second edition of the Hortus Kewensis diverted him to botany. In the "Biographical Sketch" of him his friend Robert Heward writes (p. 2):—

> "Shortly after the publication of this work (1814), the political aspect of Europe reverting once more to the state of peace, the subject of sending out botanical collectors was revived by the late lamented Sir Joseph Banks and the Superintendent of the Royal Botanic Gardens at Kew (Mr. Aiton), and the Government having acceded to the application of those gentlemen arrangements were subsequently made for forwarding two botanical collectors to the southern hemisphere."

Sir Joseph Banks having recommended Allan Cunningham as being competent to fulfil the necessary duties of botanical collector to the Royal Gardens at Kew, he received his appointment September 9, 1814, and on October 3 following sailed for Brazil in company with James Bowie.

There they spent two years. Bowie had entered the garden in 1810. After leaving Brazil he was sent to the Cape of Good Hope, where he arrived in 1817. He enriched the garden with bulbous and succulent plants. He was recalled in 1823 in consequence of the grant for collectors being reduced. He brought back with him many plants of the fine cycad *Encephalartos horridus* (Smith, Records, p. 133).

The new succulents which he introduced were described by Haworth. In the Orange River State he discovered the beautiful Amaryllidaceous plant which was received at Kew in 1823, and having flowered was figured by Sir William (then Dr.) Hooker in the Botanical Magazine as *Imantophyllum Aitoni*. "At the same time a plant "which had been surreptitiously obtained from Kew flowered in the "Duke of Northumberland's garden at Syon House, and was figured "and described in the Botanical Register by Dr. Lindley under the "name of *Clivia nobilis*." (Gard. Chron., October 29, 1881, p. 568.)

Early in 1817 Cunningham joined Oxley's Australian expedition for exploring the Lachlan and Macquarie Rivers. Subsequently he was attached to Captain King's expedition for surveying the coast of Australia, and visited various parts of the east and west coast and Tasmania. He also visited New Zealand and Norfolk Island, and in all places made large collections. Banks wrote to him April 14, 1820, not long before his death (Biographical Sketch, p. 36):—

> "I have received safe and in good condition the numerous things you have sent me, and the Royal Gardens have materially benefited by what we had from you. . . . I write you a short letter because I am not well. I know of nothing more to say to you than that I entirely approve of the whole of your conduct, as does also our worthy friend, Aiton, at Kew."

Cunningham says of this letter (B. S., p. 36) :—

> "This I shall guard as I would the essential points of the religion in which I have been educated: it is the word of a dying nobleman, whose liberality had fallen alike on the just and unjust, whose kindnesses none of us can any more experience; and if, from a sight of it, I can from time to time call up the courteous spirit of its illustrious writer to regulate my own frame of mind in the 'jostlings of the world,' literally, I shall be a happy man."

Allan Cunningham introduced a profusion of new plants. Amongst them was *Araucaria Cunninghamii*, which is now a conspicuous feature in the Temperate House, and *Laportea Gigas*, an arborescent stinging nettle (1826). Smith says rather drily (Records. p. 68) :—"Its powerful stinging properties, however, led it to meet with general ill-will from the men, and as it died suddenly it is supposed to have been wilfully killed. It has not since been introduced." The fine *Archontophœnix Cunninghamii* (Seaforthia elegans) in the Palm House was introduced by him in 1826. He found the anomalous cycad, *Bowenia spectabilis* in Queensland, though its real affinity was not ascertained till many years after.

Allan Cunningham returned to England in 1831. But he again left in 1836 to fill the post of Superintendent of the Sydney Botanic Garden, vacant through the death of his brother Richard, who was killed by natives while on Major Mitchell's expedition to discover the source of the Darling river in 1835. Allan Cunningham himself only lived to 1839. He was a remarkable and an industrious man. His numerous manuscripts, as well as his private herbarium, are preserved at Kew.

Prince Regent.

The King's malady had become permanent in 1810. From this time for the next 30 years Kew, undoubtedly, though with some spasmodic efforts at recovery, went steadily down hill. To quote Scheer (pp. 22, 23) :—

> "During the non-intercourse with the Continent the arts of peace were in a somewhat dormant state in England; save that a new science (chemistry) sprung rapidly into notice, and became, in the hands of a master-mind, pre-eminently popular and fashionable; so much so that it cast botany for a while in the shade. But when the crowned heads visited England in 1815, the attention of George IV., then Prince Regent, was drawn to the abode of his earlier days, and to the pursuits which had so much interested his Royal parents and family. The Imperial and Royal guests put in many applications for specimens of this then unique collection of plants, and the Prince delighted in gratifying their wishes; and an active intercourse with the managers of foreign gardens, and with scientific men, was for a while resumed."

To this revival the part taken by Kew in the ill-fated expedition to the Congo may perhaps be attributed.

David Lockhart.

Lockhart was a native of Cumberland, and a gardener at Kew. He sailed in February 1816 as assistant to Christian Smith, the botanist, in Captain Tuckey's expedition. He was the sole survivor of the scientific staff, and "went farther than any of the expedition." He sent to Kew a number of plants, such as *Gardenia longiflora* and others.

The narrative of the expedition was published in 1818. Christian Smith was a Dane. He had visited Madeira with Von Buch whom he had met at the house of Sir Joseph Banks. He was offered by the latter the post of botanist to the expedition. "Never were the results of an expedition more melancholy and disastrous." Out of the 54 persons which it comprised no less than 21 died, including Captain Tuckey and Professor Smith.

The following are extracts from the instructions to Professor Smith given him by the Admiralty :—

> "In order to enable him to execute his laborious duties, a gardener from His Majesty's Botanical Garden at Kew has been assigned to assist the Professor in drying and preserving as well as in collecting specimens . . . . .
>
> "He is also directed to collect the seeds of all new plants which may offer themselves for the use of the Royal Garden at Kew; and the supply of these has been limited to two packages of each kind, sewed up, with a view to keep the stock intire, without breaking into it on any consideration; so that the whole collection may be delivered, so sewed up, to the Director of the Royal Botanical Gardens, as soon as possible after the return of the expedition to England (p. xxxviiii)."

Mr. Brown worked up Christian Smith's collections. He says (p. 420) :—

> "The Herbarium . . . . was on its arrival in England, placed at the disposal of Sir Joseph Banks."

In conclusion Mr. Brown says (p. 485) :—

> "It remains only that I should notice the exemplary diligence of the Botanic Gardener, Mr. David Lockhart, the only survivor, I believe, of the party by whom the river above the falls was examined, in that disastrous journey which proved fatal to the expedition."

In 1818 Lockhart was appointed Superintendent of the Botanic Gardens, Trinidad.

Smith (Records, pp. 229, 230), says:—

> "Between the years 1823 and 1825, a considerable number of species [of orchids] were received from Trinidad, forwarded by Mr. Daniel Lockhart, the Superintendent of the Garden, amongst which were the first plants of *Stanhopea insignis*, *Oncidium Papilio*, *Lockhartea elegans*, *Catasetum tridentatum*, *Ionopsis pallidiflora*, and others, all of which were epiphytal, and many of them being sent growing on portions of branches as cut from the trees, which, being accompanied by instructions from Mr. Lockhart as to how they should be treated, led to the successful cultivation of epiphytal orchids."

The interesting aquatic *Pontederia crassipes* was introduced to Kew by Lockhart from Trinidad.

He died in Trinidad, 1845.

KEW, 1817-20.

Patrick Neill, author of a "Journal of Horticultural Tour," gives (p. 507) a brief notice of the state of Kew in 1817 :—

> "We then looked into the Botanic Garden, where I found Mr. Begbie, the foreman, an old acquaintance. The hothouses are not placed in any regular form, but scattered over the garden. In one of them Mr. Begbie drew our attention to a plant of the *Cactus cochinillifer*, which had been brought to Britain with the cochineal-insect feeding upon it. There was still a considerable number of the insect upon the plant. In another of the houses he showed us a new species of passiflora, having eatable fruit (*Passiflora edulis*). The plant had fruit upon it at this time: it is of an oval shape, purple-coloured, about the size of a small hen egg. It has sometimes been served up with the dessert at the Royal table."

Sir Richard Phillips (Morning Walk from London to Kew, p. 379), describes in 1817 a curious sight which existed at the time :—

> "As I quitted the lane I beheld, on my left, the long boundary wall of Kew Gardens, on which a disabled sailor has drawn in chalk the effigies of the whole British navy, and over each representation appears the name of the vessel, and the number of her guns. He has in this way depicted about 800 vessels, each five or six feet long, and extending with intervening distances about a mile and a half. As

the labour of one man the whole is an extraordinary performance, and I was told the decrepid draughtsman derives a competency from passing travellers."

In 1825 Evans (p. 32) says they were "nearly obliterated."

HIMALAYAN RHODODENDRONS.

The first Himalayan Rhododendron was introduced in 1818. Smith (Records, p. 298) says :—

> "In 1818 Dr. Wallich forwarded to this country seeds of *Rhododendron arboreum*, native of Nepal, which were reared in the Botanic Gardens, Kew and Edinburgh. The seeds came up abundantly, but by over-heat the Kew breed was lost, and on my leaving Edinburgh in 1820 Mr. McNab sent two plants by me to Kew. They were then about 3 inches high ; they were grown in the greenhouse ; in 1863 they were taken to the Temperate House, and the largest is now (1889) a bushy tree 23 feet high."

In 1820 George III. died. During the time he was on the throne the botanical exploration and horticultural activity, of which Kew was the centre, was not merely unparalleled, but from the nature of things never can be paralleled again. Evans (pp. 123, 124) in 1824 sums it up numerically, though he does not say on what authority :—

> "The present royal family being greatly attached to the study of botany, his late Majesty bestowed much attention on the Garden at Kew, and had the satisfaction of seeing the example which he set followed with such ardour by his subjects, that not less than six thousand seven hundred and forty-six rare exotic plants were introduced into these Kingdoms during his reign, and exotic beauties are now seen blended with our verdure in every corner of the island."

KEW PALACE (OLD).

After the reign of George III. Kew ceased, practically, to be a royal residence. The so-called palace, a mere gentleman's mansion of the 17th century, remains, though uninhabited. Its history is not free from obscurity. But the following account embodies what appears to be most trustworthy.

The following is on the authority of Simpson (p. 15). A mansion called Suffolk House, by some Suffolk Place,

> "is mentioned in a court roll of the sixth year (1566) of the reign of Queen Elizabeth ; but at that time it had been pulled down and destroyed. This, in all probability, was the place of residence of Charles Brandon, Duke of Suffolk. This nobleman's third wife was the Princess Mary, who was sister to Henry VIII., and had been previously married to Louis XII. of France, whose widow she was up to the time of her marriage with the Duke of Suffolk . . . . Leland says . . . . . that the house was erected in the time of Henry VII., but many years before he wrote, and 'according to report, by a steward of the household.'"

Gosse ("Wandering through the Conservatories at Kew," p. 4), says :—

> "It would seem that several manors of great extent and some magnificence existed near the present entrance to the Royal Gardens. One called Suffolk Place, was occupied by a Sir John Puckering, who held the office of Lord Keeper of the Great Seal."

Simpson says (p. 16) that Sir John Puckering entertained Queen Elizabeth in his house at Kew in 1594. He could not therefore have inhabited Suffolk Place if that was pulled down in 1566.

The ancient Kew must have consisted of a number of substantial houses, of which the Old Palace is the last survivor, which were clustered about the Horse Ferry. Two roads met here, both of which were ultimately suppressed in the gradual development of the Gardens. One, the bridle road called Love Lane, which ran south to Richmond Green and Palace. Kew was thus in easy communication with the court, and would be a convenient place of residence for important persons attendant on it. The other road ran in front of the present Palace through Kew Green to Mortlake.

The present building has beneath it a Gothic crypt with a vaulted roof. In one of the rooms architectural fragments, Tudor in style, have been worked in. It seems exceedingly probable that these were fragments of Suffolk Place, upon the site of which it was erected.

Simpson (p. 30) gives the following history of the present Palace :—

> "The House now called Kew Palace (but originally the Dutch House), is an old structure of red brick, which is stated by Brayley and others to have been erected about the time of James I., by Sir Hugh Portman, the Dutch merchant who was knighted by Queen Elizabeth, and who has already been noticed as the owner of the 'Dairie House.' His descendant, Sir John Portman, sold it (in the year 1636) to Samuel Fortrey, Esq., by whose representative, William Fortrey, Esq., it was alienated in 1697 to Sir Richard Levett. Queen Caroline, in the reign of George II., when making her improvements, took a long lease of this House, which had not expired in 1781, in which year the freehold was purchased of the descendants of Levett in trust for her late Majesty Queen Charlotte, by whom it had previously been occupied as a nursery for the Royal offspring."

In Burrell's plan of the manor (1771), some land at the back of the Palace is marked with the name of Levett, so that it is probably correct that it passed into Royal possession from the family of that name. But the idea that it was ever leased by Queen Caroline seems possibly to have arisen from a confusion with the neighbouring house on the other side of Love Lane, which is known to have belonged to her.

The Palace, though called the "Dutch House," has nothing Dutch about it. It is an interesting specimen of Jacobean architecture. The removal of an unsightly wooden porch a few years ago revealed the date over the door, 1631, with the initials F.S.C. This date is, possibly, subsequent to that of its erection. According to Scheer (p. 17), Dutch merchant was simply equivalent to sugar refiner.

Simpson (p. 14) says the Dairie House belonged, in the reign of Edward VI., to Sir Henry Gate. In the reign of Queen Elizabeth it became the property of Robert Dudley, Earl of Leicester. It afterwards passed in to the hands of Sir Hugh Portman. Nothing more is known about it, though it is possible that it and not Suffolk Place supplied the more ancient foundation of the present building.

In Rocque's plan (1734) the Palace is called the Princess Royal's House ; by Chamberlain (1769), the Princess Amelia's. George IV. (born 1762) was educated here "under the superintendence of Mr. " Markham, afterwards Archbishop of York." (Scheer, p. 17.)

In 1803 Kew House was pulled down except the stables and kitchen offices, which still remain. From this date till the King's death in 1820 the Royal family resided in the present Palace when at Kew. During this time a public road leading from Kew Green to Brentford ferry passed in front of the Palace and between it and the kitchen offices.

Walford (p. 396) says that the marriages of the Duke of Clarence and of the Duke of Kent to the Princess Victoria of Saxe-Coburg were celebrated here by the Archbishop of Canterbury and the Bishop of London on Saturday, July 11, 1818, "when a temporary altar was " fitted up in the Queen's drawing room, which looks into Kew Gardens, " on the first floor."

On November 17 of the same year Queen Charlotte died here. According to Simpson (p. 31) she was taken ill at Buckingham House. " By the advice of her physicians the Queen was to have been removed " to Windsor, but not being sufficiently recovered she stopped at Kew " Palace." Walford (p. 395) says the room was at the top of the staircase on the second floor.

HERBARIUM AND LIBRARY.

One of Sir Joseph Banks's schemes was to found a herbarium and library at Kew. Scheer (p. 50), speaking of Bauer, says:—

> "To some of his performances we have had occasion incidentally to allude; those which he accomplished during the life-time of Sir Joseph Banks were, by the will of the latter, deposited in the British Museum; and since the plan of Sir Joseph, though once eagerly entered into by George IV., for establishing a Botanical Museum at Kew, has been abandoned, but for which originally the house now in the possession of the King of Hanover was purchased; we trust that whatever now remains in Kew of Mr. Bauer's drawings will be in due time carefully added to the treasure already laid up in that National Storehouse of Arts and Sciences."

According to Scheer (p. 11),—

> "Sir Peter Lely purchased a house at Kew, to which, during the latter part of his life, he frequently retired; it stood somewhat upon the ground now belonging to the mansion of His Majesty the King of Hanover."

Q. C. (p. 3) says the latter was built on the site of Sir Peter Lely's house. But this is improbable.

This is now the Herbarium and Library of the Royal Gardens. The latter occupies the original house, the former an addition to the north.

Sir Peter Lely's house probably stood to the west and no trace of it remains. The herbarium house was originally known as Hunter House, having been the property of Robert Hunter (Smith, Records, vii), who is traditionally reported to have been a friend of the elder Aiton's, and having succeeded in business, to have settled at Kew. It was built anterior to 1771, as it appears in a copy of Burrell's plan of that date lent by Her Majesty the Queen to the Kew Museum. It is believed to have been purchased for the King in 1818 at the instigation of Sir Joseph Banks for the purpose to which it is now dedicated. A room on the ground floor was fitted (1820) with bookshelves [Kew Report, 1875, p. 2], which remained till 1877, but were apparently not used at the time. Banks and the King both died in 1820, and the library and herbarium of the former were bequeathed to the British Museum, of the Botanical Department of which they became the foundation. Banks appears to have been allowed to retain the botanical specimens brought home by the Kew collectors. The bulk of that part of their labours is therefore to be found in the British Museum.

In 1823 George IV. sold Hunter House to the nation. About 1830 William IV., notwithstanding, granted its use to the Duchess of Cumberland for her life. On the Duke's accession to the throne of Hanover it became generally known as the "King of Hanover's house." The King of Hanover resided in it occasionally, but after his death in 1851 it was unoccupied. In 1852 its use for Herbarium purposes commenced.

GEORGE IV.

George IV. took at first much interest in Kew, and adopted the plan of adapting Hunter House to its present purpose. In 1823 he acquired by Act of Parliament the west end of the green and erected a tall iron railing, which brought Hunter House within the garden area.

The effect was to close and throw into the garden the old road from Kew Green to Brentford Ferry. "The preamble recites that."

> "Parte of the Waste of the said Manor [Kew Green], divides a Messuage and Grounds belonging to His Majesty on the North side thereof [Hunter House], from

other Grounds [Kew Gardens] belonging to His Majesty on the South and West sides thereof: And . . . . . . the Inclosure and Addition of so much of the said Waste as divides the said Grounds, and of the Road from the said Common to the Ferry called Brentford Ferry, would be a great Improvement to the said Property of His Majesty."

Across the end of the Green so enclosed, the King erected a tall iron railing from the corner of the official residences on the north side of the Green (of which the most eastern had formerly been occupied by Meyer the miniature painter) to the corner of the present official residence of the Director.

Evans (pp. 130, 131) in 1824, describes the Gates erected by George IV.

"In the centre of Kew Green, his present Majesty has just erected large handsome iron gates, crowned with the lion and unicorn couchant, not altogether dissimilar to the grand entrance at Hampton Court. Iron pallisades also extend on both sides, thus separating the royal domains from the intrusion of vulgar curiosity! The whole has an imposing effect, and may be pronounced a distinguished improvement."

The so-called Bird-cage Walk, with its dwarf iron railings, was apparently outside George IV.'s new fence. The lime trees were planted by John Smith about 1820.

The Act provided that in compensation to the parish, a new footway from Kew Green to Brentford Ferry, along the river side, as well as roads round Kew Green should be made, and that all the roads in the parish should, in perpetuity, be maintained by the Crown.

The Philosophical Magazine for 1824 contains (vol. vi. pp. 365–6) in a paper "On the cultivation of Botany in England," by Professor Schultes of Landshut, an account of Kew about this time which is far from flattering:—

"Lagasca and I met almost daily, ... and made some botanical excursions together: among other places, to the celebrated gardens at Kew. We did not see Mr. Townsend Aiton, as he had been called away to Windsor; but in this well known garden, whose catalogue has given it so much celebrity, we did not find the pleasure that we had anticipated. We were disappointed particularly in the plants which grow in the open air, which are not so accurately named as those in the Göttingen Botanic Garden, superintended by Schrader: sometimes the same species is marked with two different names. The garden at Kew consists of a fine park, and of a large botanical garden of about twenty acres. What we usually term a park in Germany is like anything rather than what receives the same appellation in England; and which is neither more nor less than a wood, in which nature and art seem to dispute for the original formation and present possession. As in a wood, one may walk, ride and drive about it, without risk of interruption. English parks are in fact beautiful woods, and nothing more; and it will ever remain one of the most difficult problems in the delightful science of laying out pleasure grounds, so to plan a charming wood, as he who is in it shall not know whether he be in a grove or a park. We have on the Continent many exquisitely formed gardens, under the name of English ones; but an English park I have only seen in England. The Botanic Garden at Kew is surrounded by high walls, and intersected with long squares. With regard either to its plan, or its nine or ten stoves, it will not bear a comparison with those of Malmaison, or the Grand Duke of Weimar, of Prince Esterhazy at Eisenstadt, or even with the botanical division of the Imperial Garden at Schönbrunn. A supplement to the *Hortus Kewensis*, under the inspection of Sir Robert Brown, will soon be published: many species which were formerly cultivated here are said to be lost."

About 1823 when Professor Schultes visited Kew the aspect of the small portion of the grounds to the north near Kew Green, which then constituted the whole of the Botanic Garden and Arboretum must have been very singular and totally different from what it is at present. It consisted in fact of a series of inclosures surrounded with brick walls, the greater portion of which have been since removed.

ARBORETUM.

The Arboretum, which was the most northern portion, was about five acres in extent. John Smith (Records, p. 260) says:—

> "Although the area was small, it was a remarkable spot after entering, the scene conveyed the idea of its being the interior of a large forest crowded with underwood; and it was the resort of hundreds of birds."
>
> "It was circumscribed by a 6 ft. gravel walk." (Smith, p. 258.)

In 1823 "the general collection was about fifty or sixty years old; "the average size of the trees being 40 to 50 feet high." Many of them, as has already been stated, came from the garden at Whitton of Archibald 3rd Duke of Argyll.

Near the Temple of the Sun, which was about the centre of the whole establishment, grew the first introduced plant of *Aucuba japonica.*

The most tender species were planted against the walls. The fine *Salisburia adiantifolia* was so trained; it is now a tall tree. "When "against the wall one of its side branches early produced male flowers." The old existing specimen of *Buxus balearica* was also on a wall.

William IV. in 1830 "removed the west and north boundary walls of the Aboretum. By so doing, the winds had freedom to play their part, and from time to time many fine trees were blown down." (Smith, Records, p. 260.)

The latter wall had been the boundary wall dividing the Royal Gardens from the public road to Brentford Ferry.

DEODAR.

Smiths says (Records, p. 287):—

> "*Cedrus Deodara* is recorded in some books to have been introduced in 1822; as regards seeds such may have been the case, but on account of the long voyages and manner of packing none appear to have vegetated; the first that did so, were brought home by the Hon. Leslie Melville, in the year 1831, who on visiting the Gardens gave me a few seeds which he had loose in his pocket, one of which vegetated, and after several years nursing was planted in the old Arboretum where it now stands. In 1864 it had attained a height of 32 feet, girth 4 feet 5 inches, at 2 feet from the ground, and spread of branches 28 feet."

The tree became unhealthy and was taken down a few years ago. Near its former position is one, now nearly as large raised from seed, ripened in England, by Sir T. D. Acland, Bart.

HERBACEOUS GROUND.

The Herbaceous ground was south of the Arboretum. In it grew the *Ostrya vulgaris, Sophora japonica* and *Araucaria imbricata* which still remain. It was itself bounded to the south by a wall removed by Sir William Hooker in 1847; a small portion still remains at the back of the Hardy Fernery.

Outside the Botanic Garden were the Pleasure Grounds which were therefore much larger in area than they are at present.

> "In 1843 about 45 acres of the pleasure ground, contiguous to the Botanic Garden, were added to the latter, separated by a wire fence, the greater part being grass, mowed in summer for hay, the lower part being the filled up lake of George III. (a bog in winter), there being very few trees, except those on the mount, and the weeping willows round a piece of water called the pond, next the Richmond Road, and a row of old elm trees called the seven sisters." (Smith, Records, p. 269).

The Kew Guide says these were "named in allusion to the daughters of George III."

The Pleasure Grounds of Kew Gardens proper extended from the Palace to the Pagoda almost without a break of any sort or description.

Evans (p. 125) describes them (in 1825) as "reaching for a full mile, " from the Pagoda down to the Palace at Kew, and strewed with new " mown hay of a peculiar luxuriance and fragrancy."

George III.'s Lake.

The present pond is only a fragment of a large piece of water which occupied the site of the Palm House and extended to the west of it. Smith says (p. 172) that this was "the lowest ground in the parish of " Kew, consisting originally of lagoons, which George III. converted " into a lake. It was filled up in 1814." The lake is shown on Burrell's plan in 1771; it contained an island to which access was obtained by Sir W. Chambers's bridge. There seems reason to think that the "lagoons" spoken of above were part of a chain of ponds which ran through the parish to the N.E., and were themselves the remains of a shallow creek or backwater of the Thames.

During the reign of George IV. no collector seems to have been employed. But Kew gardeners, who obtained employment abroad, were not unmindful of the establishment. A few of these deserve a brief record. The particulars are from brief memoranda left by John Smith, which have also been made use of in giving an account of the regular collectors.

St. Helena.

Thomas Frazer, a native of Scotland, was at Kew in 1820. He sailed for St. Helena in 1821, having been engaged to cultivate vegetables for the East India Company's ships. He returned in 1825. He brought back a twig of the weeping willow which grew by the tomb of Napoleon. This was grown at Kew (*see* Smith, Records, pp. 261, 262), and was for many years one of the lions of the place. Gosse gives a picture of it (Wanderings, p. 292); it was cut down in 1867. Frazer also introduced *Buddleia madagascariensis*, the cabbage tree of St. Helena, &c. He was afterwards foreman in the Royal Garden at Frogmore.

Swan River.

William Morrison, a native of Scotland, was at Kew in 1824. He went to Barbados to superintend a sugar plantation. He visited Trinidad, and returning to England in 1828 brought a large collection of seeds, plants, and dried specimens. He was again employed at Kew, and was sent to France to bring home a large purchase of orange trees for the garden at Windsor.

In 1829 the Swan River Colony was founded, and Captain (afterwards Sir James Stirling) was appointed Governor. He took Morrison with him as gardener: he subsequently became a seed collector, and forwarded collections to this country for sale (Smith, Records, pp. 10, 11). Many of the Swan River *Proteaceæ* were introduced to Kew through Morrison.

Kew Palace (New).

Kew House had been taken down by George III. in 1803, and about this time he commenced the erection of a new palace by the river side contiguous to what is now called Queen Elizabeth's lawn.

Wraxall describes (Memoirs, vol. v., pp. 378, 379) "the Castle in Kew Gardens" as he calls it.

> "Its position opposite to the smoky and dusky town of Brentford, one of the most detestable places in the vicinity of London, only separated by the stream of

the Thames, is very unkingly as well as incommodious. Though still unfinished, unfurnished, and uninhabited, as it will probably ever remain, it presents to the eye an assemblage of towers and turrets, forming a structure such as those in which Ariosto or Spencer depicture captive princesses detained by giants or enchanters."

Sir Richard Phillips describes (1817) the interior (Morning Walk from London to Kew, pp. 380, 381).

"In the western corner [of Kew Green] stood the building called Kew Palace, in which George III. passed many of the early years of his reign, and near which he began a new structure a few years before his confirmed malady, which I call the Bastile Palace, from its resemblance to that building, so obnoxious to freedom and freemen. On a former occasion, I have viewed its interior, and I am at a loss to conceive the motive for preferring an external form, which rendered it impracticable to construct within it more than a series of large closets, boudoirs, and rooms like oratories. . . . . The works however have been suspended since the unhappy seclusion of the royal architect; and it is improbable, at least in this generation, that they will be renewed. The foundation is in a bog close to the Thames, and the principal object within its view is the dirty town of Brentford, on the opposite side of the river."

Q. C. (p. 10) describes its destruction.

"The gothic palace which King George III. began at the commencement of the century, was, after standing some years empty, useless, incompleted, decaying, sold by George IV. to a builder for materials. The demolition took place in 1828 or 1829. On Saturday morning, December 8th, some injudicious removal of material was made by the workmen, and one of the eastern towers came crashing to the ground. . . . . Eight men were killed. . . . . Years after part of a skeleton was found embedded in the earth. . . . . The King, having heard of the accident, ordered the rest of the towers to be blown up."

Simpson (pp. 28, 29) seems to imply that the Gothic Palace was commenced earlier than 1803 :—

"Kew House, or the 'Old Palace,' as it was afterwards called, was taken down in 1803, a new Palace in a castellated form having been commenced and partly built by command of the King, on a spot on the banks of the River Thames. Vast sums of money had been expended in the erection of the exterior, which was of compo-work, but the building was never finished internally, nor was it ever inhabited by the King, and after his death it was sold piecemeal by order of George IV., the last of its materials having been removed in 1827. The designs for the buildings were by James Wyatt, the celebrated architect."

Sir W. Hooker, in his Report for 1847, explains how the site was eventually treated :—

"The private grounds of the Palace had been much neglected, especially that portion (about seven acres) on which His Majesty George the 3rd had built the shell of a larger palace. After the demolition of this structure the ground remained untouched, though capable of being made very ornamental; and the boarding had ever since continued, and was the only fence between the said site and the beautiful public walk next the river. The whole of this ground has been cleared, levelled, and laid down as lawn; shrubberies have been planted, the boarding taken away, and a sunk fence or haha, has been made, and a part of the ground given to the public, on which a terrace has been formed, and a gravel walk leading to a new entrance of the Pleasure Grounds. A new gate, from a design of Mr. Burton, plain in style, but well adapted in accordance with the old palace, has been erected at the approach to the palace from the river."

Simpson (pp. 76, 77) describes two remarkable trees which stand near the Palace :—

"Visitors at Kew are always anxious to see two venerable trees near the Ferry, on the banks of the river, I mean the Elm and the Linden. The former is, or rather was, a most beautiful specimen of luxuriant vegetation; it was planted by Queen Mary I. [on the Ordnance Map it is called Elizabeth's Elm], and was blown down in 1844, the top having since been made into a kitchen table for Osborne House; the trunk is still carefully preserved by being railed in, and measures 29 feet in circumference. The Linden tree is of singular beauty, and is of great height. Under this tree, it is said, most of the family of George III. used to sit and pursue their youthful studies."

Only a fragment of the trunk of the Elm remains, but the original dimensions are still preserved by the young stems which have sprung up from the circumference. Its longest diameter (1893) is 10 feet.

In the early part of his reign George IV. abandoned Kew for Windsor, and its scientific interests were neglected. He seems still to have retained some affection for Kew. Croker writes to Lord Hertford Jan. 19, 1831:—"I am told His Majesty has lately expressed some "regret that he is too old to begin building at Kew, which is what "he would most like." (Croker Papers, ii. p. 101.) The King died in the following year.

SIR EVERARD HOME.

In the same year Sir Everard Home also died. He seems after the death of Banks to have in some measure assumed the task successfully performed by Lord Bute and the former of affording external scientific encouragement to Kew. Scheer says (p. 36) that Sir Everard Home "for some length of time used to meet here, almost every Saturday, "at Mr. Bauer's, many of the eminent men of the day, for purposes "connected with botany and other branches of Natural Philosophy, "and a friendly social intercourse." And (p. 23) he mentions the death of Sir Everard Home as one of the circumstances which "appear "to have begot an indifference about these gardens, which it is difficult "to account for on any reasonable grounds." In 1820 Sir Everard Home published in the Philosophical Transactions some anatomical observations as they "appeared in the microscope of F. Bauer, Esq."

WILLIAM IV.

William IV. seems to have taken a warm interest in Kew and effected several improvements. But the elder Aiton had become Director-General of the Royal Gardens at Kew and elsewhere, and among the duties of so onerous a post the care of Kew must have taken a somewhat subsidiary place. Kew certainly did not gain ground in scientific importance during the King's reign, and it got almost wholly out of touch with the scientific botanists of the day.

The King built in the Pleasure Grounds the small temple which bears his name, but seems at the time to have had the grandiloquent title of "The Pantheon," a "Temple of Military Fame." It was erected by Sir Jeffery Wyatville to commemorate "the battles fought "by British soldiers from 1760 to 1815." A local tradition is that as the workman was cutting the King's initials on the pediment the great bell of St. Paul's began to toll to announce the King's death.

ARCHITECTURAL CONSERVATORY.

Smith (Records, p. 96) says:—

> "During the latter years of the reign of George III. and George IV., a new Palm House was contemplated, and a plot of ground set apart for its erection; but nothing was done until the accession of William IV., who took much interest in improving the Gardens, and in 1834, a plan for a spacious Palm House was prepared by the celebrated architect, Sir Jeffrey Wyatville, and in October 1834, a spot was selected and the length of the house marked out in the presence of the King."

The plan was, however, abandoned on William IV. removing to Kew (in 1836) from Buckingham Palace (where it was replaced by a chapel), the great architectural conservatory which stands near the

Main gate. This was erected on the ground which had been taken from Kew Green. Up to 1848 it was used as a Palm-house. In that year—

> "Its contents consisting of Palms and other tropical plants, were removed to the [new] Palm-house, and it was immediately occupied by the larger growing kinds of Australian plants, such as *Myrtaceæ*, *Leguminosæ*, and *Proteaceæ* . . . . some of the Banksias becoming large bushes and flowering profusely." [Smith, Records, p. 64.]

These in turn were removed in 1863 to the Temperate House. It is now used for *Aroideæ* and other plants requiring an extreme tropical treatment.

William IV., as already stated, removed the wall of the old Arboretum to the west and north, which ran from the "Ice House" to the east end of the Orangery. This was the first step in the policy of opening up the grounds, which has been pursued ever since.

According to a memorandum of a conversation with John Smith, William IV. in 1830 removed the high railing erected by George IV. across the west end of the Green, and the gates and lodges at either end of it. He used the gates and part of the railing to inclose the front of Hunter House. (This inclosure was set back in 1880.) The other part was erected across the space between the present house of the Keeper of the Herbarium and the wall of Hunter House grounds. It was bent into the present sweep when the Main gate was erected in 1845.

OLD ENTRANCE.

At this time there does not appear to have been any entrance where the Main gate now stands. Evans says (p. 122) in 1824:—"The "entrance is on the upper side of Kew Green, whilst another is in "Richmond Road." The former was on the south side of the Green, where the engine-house now stands. It was narrow and inconspicous; but it was not superseded till 1845, when the Main gate was erected by Decimus Burton.

The "Lion and Unicorn Couchant," which Evans describes as adorning George IV.'s gates, now perform the same function on two gates in the Richmond Road. The lion was at first on the present Unicorn Gate. The present Lion Gate was called the Pagoda Gate. On "Sept. 9, 1849, Mr. Jesse proposed to purchase for 7*l.* the unicorn "sold at sale of Kew effects, and place it on the top of entrance at "Pagoda." This was done, but the position of the two figures was interchanged.

ORCHIDS.

In 1833 George Aldridge brought a collection of living orchids from Trinidad. He was son of John Aldridge, many years foreman of the Royal Kitchen Garden at Kensington, afterwards Superintendent of the Royal Kitchen and Forcing Garden at Kew. George Aldridge went to Trinidad in 1831, and returned on account of bad health.

Smith says (Records, p. 235) that in 1826 about 60 species of orchids were cultivated at Kew. "New ones were, however, successively "added, and in 1836 a small house was erected, and appropriated to "the cultivation of tropical species."

VOYAGE OF THE "SULPHUR."

In 1835, George Barclay, a gardener, who entered Kew in 1833, was appointed botanical collector to H.M.S. "Sulphur" (Captain Belcher), which was about to proceed to western S. America for surveying purposes. Various parts of the American coast were visited northward to Sitka. The Sandwich, Fiji, and other islands of the Pacific were also visited, and Barclay reached England with his collections in 1841. The botany of the voyage was worked out by Mr. Bentham.

NATHANIEL WILSON.

Nathaniel Wilson, a native of Scotland, was at Kew in 1834 and 1838 He went to Jamaica to cultivate coffee in 1847. He was appointed Curator of the Botanic Gardens at Bath. He sent many plants to Kew such as tree and other ferns, the Lace Bark Tree, &c. He cultivated the first specimens of Cinchona, raised in Jamaica from seed sent from Kew by Sir William Hooker. He paid much attention to fibre plants, and his collections formed one of the first contributions to the Economic Museums at Kew. He retired in 1867, and died about 1873.

ADMISSION OF THE PUBLIC.

Although till after the death of William IV. Kew was essentially a private establishment, it was by no means inaccessible to the public. In 1819 Rees's Cyclopædia says: "The Gardens at Kew are opened every "Monday during the Summer." In 1825 Evans (Richmond and its Vicinity, p. 122) says: "The Gardens are open to the public on Sunday "from Midsummer till Michaelmas." In 1838 Dr. Lindley reported to the Treasury :—

> "Visitors are unreservedly admitted to the Garden daily, except on Sundays, and Mr. Aiton deserves credit for having exercised his power as Director-General, in order to secure this privilege to the public. It is, however, not easy to discover what advantage, except that of a pleasant walk, has been derived from the privilege in the past state of the Garden."

Scheer (p. 47) in 1840, says :—

> "The Pleasure Grounds, which are quite distinct from the Botanic Gardens, are open to the Public on Thursdays and Sundays from Midsummer till Michaelmas."

Kew had gradually in proportion as the direct interest of royalty in its maintenance diminished, assumed a quasi-public character. Its management became the subject of criticism which certainly did not err on the side of being out-spoken.

DEAN HERBERT.

The Hon. and Reverend William Herbert (afterwards Dean of Manchester), a well-known and creditable writer on bulbous plants, delivers himself of the following bitter complaint in his Amaryllidaceæ (1837, pp. 247–8) :—

> "The illiberal system established at Kew Gardens by Sir Joseph Banks, whereby the rare plants collected there were hoarded with the most niggard jealousy, and kept as much as possible out of the sight of any inquirer, led in the first instance to a feeling of satisfaction, whenever it was known that the garden had been plundered and some of its hidden treasures brought into circulation; and the indifference with which such thefts were regarded, if they were not actually winked at, by cultivators, led to such great laxity of conduct, that, until the practice was stopped by a prosecution, every private collection became exposed to like depredations; and the

> falsehoods that were told to cover the theft occasioned a great deal of confusion concerning the native habitation of plants introduced at that period. It was the narrow-minded doctrine of Sir J. Banks that he could only render the King's collection superior to others by monopolizing its contents; and by doing so he rendered it hateful and contemptible: whereas if he had freely given and freely received, and made its contents easily accessible to those who were interested in them, it would have been a pleasure and a pride to the nation. It is now near 20 years since I have visited that odious and useless establishment. Formerly I went there often, but always in vain, for if I inquired for any rare plants, which I had reason to believe were in the collection, excepting those which, from their size, could not be concealed, my conductor always denied any knowledge of them; and if I asked whether I could speak to a person better acquainted with the plants, I was told that I could obtain no further information. The multitude of rare plants that have flourished and perished there unobserved I believe to be very great. I owe no thanks to that establishment, but for the mere permission to walk straightforward through the houses. I must do Mr. Salisbury the justice to say that he repeatedly remonstrated with Sir Joseph Banks in vain on the subject."

The ethical standpoint which animates this pronouncement is somewhat odd for a Dean. And the strictures themselves are not on a much higher level. In the first place Kew was a private establishment, of the Sovereign it is true, but over which it is not obvious that the public generally had any definite rights. The attack on Sir Joseph Banks is probably not really grounded on facts, and, even if it were, it must be remembered that the scientific esteem which Kew acquired was entirely due to Banks who, without any official position, and simply as a personal friend of the King's, spent a scarcely calculable amount of time, pains, and money in making the Kew Botanical collections the first in the world at the time. Royal interest can, no doubt, effect a good deal, but it cannot be doubted that, without the scientific advice and encouragement which Banks rendered to the King, it would have been impossible for Kew to have attained the scientific eminence which it reached under the two Aiton's.

The anonymous writer (1838), probably Lindley, in the article "Garden" in the *Penny Cyclopædia* (vol. xi., p. 74), is scarcely less severe.

> "The chief English garden, containing a large collection of plants, is that of Kew, which is certainly the richest in the world in New Holland Plants, and which was during the late war, almost the only place in Europe to which exotic plants were introduced in considerable quantity. It contains a bad and ill-named or rather unnamed collection of hardy plants, and a good many small hot-houses and green-houses filled with rare plants; there is, moreover, an excellent kitchen-garden and forcing department. In consequence of this establishment having had a monopoly of government support for above 30 years, it has been the channel through which an enormous quantity of new plants have been introduced to Europe from all parts of the world. For many years however it was unworthy of the nation, from the illiberal manner in which it was conducted, a system of exclusive possession having been observed in it, which was most disgraceful to those by whose authority it was maintained, and who acted as if such gardens were supplied by the public purse for the private gratification of a few selfish courtiers, and not for either the crown or the country. Of late years, however, this system has been abandoned, a liberal management has been introduced, and the collection is as accessible as that of other nations."

There can be no doubt, however, that these complaints and criticisms, whether justified by the circumstances of the time or not, had a powerful effect on the future fortunes of Kew. They stimulated an amount of interest in its maintenance as a scientific institution which ultimately brought about its development upon its present scale.

Dr. Lindley's Report.

William IV. died in 1837, and in January 1838 the Treasury appointed a committee "to inquire into the management, &c. of the Royal Gardens." It consisted of Dr. Lindley, in conjunction with two practical gardeners, one of whom was the future Sir Joseph Paxton. The committee reported in February following.

The report is too long to quote. But a few paragraphs are useful as giving an idea of the state of the establishment at the time :—

> "This garden is situated on the south side of Kew Green, bounded partly by the walls of the Royal Forcing and Kitchen Gardens and partly by what is called the Pleasure Ground of Kew Palace. It is reported in the official returns to occupy 15 acres, of which part is Arboretum, and the remainder filled by stoves and greenhouses, borders of Herbaceous Plants, spaces left for the arrangement of greenhouse plants in the open air in summer, offices, yards, &c."
>
> "The Arboretum contains many very fine specimens of hardy Exotic trees and shrubs, but the collection is not very extensive, and the plants are too much crowded."
>
> "The collection of Herbaceous Plants appeared to be inconsiderable. A certain number were marked with their names written on painted sticks, others were unnamed; no systematical arrangement was observable with the exception of Grasses, of which there is an extensive collection named."

Scheer (p. 41) speaks of this collection (1840) :—

> "Which we believe is as complete as possible, and which was dear to George III., because of his patriotic fondness for agriculture."

The report continues :—

> "The stoves and greenhouses have been built, with two exceptions, in the neighbourhood of each other in an irregular manner, and apparently, from time to time, as occasion arose for successive additions. Some of them are old, but in general they are in pretty good repair. They may be described as follows :—
>
> "1. A palm stove, 60 feet long, containing, among other things, some fine old palm trees planted in the ground. [One of these was the large *Sabal blackburniana*, which is so striking an object in the present Palm House. John Smith (p. 122) found it at Kew in the spring of 1820. But there was no record of its introduction. He supposes it to have been brought by Admiral Bligh from the West Indies in 1793.]
>
> "2. A stove, 50 feet long, filled with a miscellaneous collection of stove plants.
>
> "3. A stove, 60 feet long, with two small tanks for water plants, occupied by a miscellaneous assemblage of stove plants.
>
> "4. A small span greenhouse, 40 feet long, with a miscellaneous collection of small New Holland and Cape plants. [Built 1803.]
>
> "5. A dry stove, 40 feet long, in two compartments, filled with succulent plants.
>
> "6. A greenhouse, 60 feet long, chiefly filled with fine specimens of Cape of Good Hope and New Holland plants, among which are some noble Banksias. [Built 1792.]
>
> "7. A double propagating pit.
>
> "8. A greenhouse, 30 feet long, containing small Cape of Good Hope and New Holland plants.
>
> "9. A 'Botany Bay' house, 110 feet long, crowded with magnificent specimens of New Holland and other plants, especially the former. [Built 1788.]
>
> "10. An old stove, reported to be the first house erected in the Gardens, 110 feet long, in three divisions, one containing noble specimens of succulent and other plants; the second, a stately *Zamia pungens* [no doubt, Masson's *Encephalartos*], palms, &c.; and the third, a miscellaneous set of greenhouse plants, together with a few forced flowers for nosegays." [Built 1761.]

Of these, 2 and 3, have been united to form the present No. 2 (Tropical Ferns); 4 and 5 have been united to form the present No. 3 (Temperate Ferns); 6 with additions by Decimus Burton is the present No. 4 (Greenhouse). The propagating pits have been reconstructed for orchid cultivation. All the other houses have given place to larger, more convenient, and more modern buildings.

Nos. 4, 6, and 9 were built on ground purchased by George III. from the Rev. W. Methold (to whom the Director's official residence formerly belonged), and added to the Botanic Garden.

To return to the report :—

> "The first thing to remark upon the specimens in the houses just described is, that they are excessively crowded, and some of them are out of condition from this

> circumstance. In general, however, the plants, especially those from New Holland, are in excellent health, clean and well attended to; the general appearance of the collections was, moreover, very creditable."

John Smith, who was foreman at the time, and who was subsequently the first Curator of Kew, as a public establishment, seems to have felt, and it must be admitted with some reason, that the report of the Treasury Committee scarcely did justice to the state of the Gardens. There can be no doubt, from independent tradition, that the collections of Cape and New Holland plants must have been incomparable, and such as have never been surpassed since.

He says (Records, p. x.) :—

> "It will be seen by the date of the above Report that the examination of the Garden took place in the month of February 1838, just after one of the severest winters on record, and heaps of melting snow still lying on the ground, and all evergreen shrubs presenting a sorrowful aspect. * * The herbaceous collection, if it had been examined in summer, and time taken, it would have been found to contain about 2,500 species of perennial plants, arranged according to the Linnæan system."

Colonial Correspondence.

An important paragraph in the Report relates to the interchange of plants with other gardens, and he (Dr. Lindley) says "that no communication with Colonial gardens is apparent from the Garden Book of "Delivery." Smith shows that this statement was based on a misapprehension. He proceeds:

> "With regard to Colonial gardens in the east, Mauritius for instance, had received all the useful fruits and vegetables from the French West Indies and other countries before it became a British Colony; in 1818 a selection of useful plants was sent, and after that collections of the finest kinds of European fruits were sent from Kew. New South Wales was also early supplied with useful fruits suitable to its temperate climate, and there was a considerable intercourse with India and China through the East India Company's ships, in some cases on an extensive scale, as for instance in the spring of 1806, fourteen boxes of plants were sent by the ship Thames to India. * * * In the same year a large collection of succulents was also sent to Calcutta."

* * * *

> "The above is sufficient to show that Kew has not been backward in supplying the Colonies and Botanic Gardens of Europe with rare plants, and that matters were not so bad as represented by Dr. Lindley in his report."

Dr. Lindley reported in 1838, but his report was not presented to Parliament till May 12, 1840.

Of what took place in the interval Smith gives an account (Records, pp. xii., xiii.) :—

> "In the autumn of 1839 the Lord Steward, then Lord Surrey, who in virtue of his office had the whole control and management of the Royal Gardens, paid frequent visits to the Botanic Garden, always accompanied by the Superintendent of the Kitchen Garden, and carefully examined the greenhouses and pits; and it became known that it was his intention to convert them into vineries and pine-stoves, and that the plants had been offered to the Horticultural Society for their garden at Chiswick, and also to the Royal Botanic Society for their garden at Regent's Park; but the offer in both cases was declined. The vinery scheme was, however, intended to be carried out, and on the 18th of February 1840 the kitchen gardener informed me that he had received instructions from Lord Surrey to take possession of the Botany Bay House, and convert it as soon as possible into a vinery, and that the Cape House was to follow, and to enable him to do so he was to destroy the plants. This becoming known to the public led to articles in several public journals condemning the scheme as being a disgrace to the nation. This had the desired effect, and Lord Surrey's scheme was abandoned."

Frederick Scheer.

This was the occasion of the publication (1840) of the excellent historical account of Kew published by Frederick Scheer under the title of "Kew and its Gardens." Scheer was an independent botanist who had particularly devoted himself to the study of *Cactaceæ*. He described the plants of that family collected by Seemann for the "Botany of the Voyage of the Herald," published by that botanist (1852–57). Sir William Hooker (1853) figured *Scheeria mexicana* (Bot. Mag. t. 4743) named by Seemann in his honour.

> "To whom our gardens are indebted for the introduction of several other ornamental plants, and to whose successful study of Cactaceæ science owes many interesting additions."

Scheer describes himself as a Kewite, by which, no doubt, he intends that he resided at Kew. He certainly knew the affairs at the time and the history of the gardens as well as anyone living on the spot could know them. His pages have been borrowed from freely in this account, and as far as his statements admit of being tested they prove extremely accurate.

In his introduction he says:—

> "The botanical world has been lately roused from the even tenor of its way by ominous rumours threatening destruction to the Royal Botanic Gardens at Kew. There is no doubt that intimation had been given to the Horticultural Society, and perhaps to others, of the existence of a desire to dispose of the plants, collected in the course of nearly a century, in these Gardens; and it has been said that the expense annually incurred was too heavy to be borne any longer by the British nation.
>
> "The Council of the Horticultural Society, with a spirit highly favourable to themselves and to science, declined becoming a party to a proceeding so inauspicious to their pursuits, and we trust that no corporate body could be found in the United Kingdom capable of deviating from the dignified course of which these gentlemen have set the example."

Discussion in House of Lords.

A brief discussion which took place in the House of Lords, March 3, 1840, "tranquillized the public mind on the matter."

House of Lords, March 3, 1840.

Kew Botanic Gardens.—The Earl of *Aberdeen* . . . . . alluded to the Royal Botanic Gardens at Kew. He had heard many reports with respect to the intention of the Government to abandon and destroy that fine establishment. He should have given little or no credit to those reports, if he had not been informed that an offer had been made to the Horticultural Society of this city to give up to them the plants in the Gardens on certain conditions. That society was very well known to be anxious to forward horticultural pursuits; but they nevertheless declined the offer. They refused to become parties to a transaction which had for its object the destruction of these Gardens. He considered the Botanic Gardens at Kew to constitute a part of the state and dignity of the Crown, which ought by no means to be separated from it. He knew not what expense this establishment might entail on the civil list; but he should be happy to see assistance given by the country, if it were necessary, in support of an object of this description. So far from desiring to destroy this establishment, he should think that Her Majesty could not favour a better object than the protection, encouragement, and cultivation of that delightful science with which those Gardens were connected. He now asked the noble Viscount, who was at the head of the Department of Woods and Forests, whether any such intention as that to which he had alluded at present existed . . . .

Viscount *Duncannon* said, that the Botanic Gardens of Kew were not under the control of his Department. But he could assure the noble Earl that there was not only not the least intention now to break up these Gardens, but there never had been any such intention. Indeed, it would have been next to impossible; for a great many of the plants could not be removed without ensuring their destruction.

Scheer (p. 56) explains the mode in which the Gardens were maintained.

"All repairs are done by the Woods and Forests. The wages and coal, which amounts to less than a thousand pounds in the year, are disbursed by the Lord Chamberlain, and voted in the annual grants for the Civil list. For collectors and for collecting the Admiralty or the Treasury have supplied the expenses. Thus, three, if not four various departments have contributed, each to an indefinite extent towards this establishment. Sir Joseph Banks in his time, also sacrificed large sums towards the advancement of the Gardens, and besides many private individuals have added considerably to the collection."

A few days after the discussion in the House of Lords the Botanic Garden was transferred to the charge of the Commissioners of Woods and Forests by the following minute :—

"THE ROYAL BOTANICAL GARDENS.

"A proposal having been made to the Lord Steward by the Chief Commissioner of Woods and Works to transfer to that department the charge of the Botanical and all other Gardens now under the control of the Board of Green Cloth, at Kew, except the Kitchen Gardens, with the sum of 800*l.* annually toward the expense of maintaining the same, and to increase that sum to 1,000*l.* a year when the retired allowance also to be paid by this department to Mr. Aiton, Superintendent of the Botanical Gardens shall cease, he being entitled to that allowance in full for length of service.

"The Lord Steward by his signature to this paper with the sanction of the First Lord of the Treasury through whom this proposal has been made, and with the concurrence of Her Majesty, to whom it has been submitted, consents to the arrangement, and directs that possession of all the said Gardens except the Kitchen Garden, be given to such Person or Persons as the Chief Commissioners of Woods and Works, may duly authorize in writing to take charge of the same from the 1st day of April next.

(Signed) ERROLL,
Lord Steward.

Board of Green Cloth,
St. James's Palace, 11 March 1840."

AYLMER BOURKE LAMBERT.

A. B. Lambert, Esq., of Boyton, Wilts, was a private gentleman of property, who took a keen interest in botany, and was well known in the scientific world. For some years he seemed to have succeeded to the *rôle* of Sir Joseph Banks, in the affairs of Kew. He came to reside at Kew in the autumn of 1839.

His correspondence is preserved at Kew, and the following extracts are taken from his letters to John Smith :—

Aug. 27, 1836. "I am rejoiced to hear that your new houses go on so rapidly." This no doubt refers to the Architectural Conservatory.

April 13, 1837. "I particularly and impressively desired [him] to collect all the seeds and plants for the Royal Gardens, Kew, which he has most faithfully promised to do."

This refers to an "Admiralty Purveyor," who was going to the Bay of Islands.

Feb. 13, 1840. "I have just been with Sir Charles Lemon, and am sorry to say that Kew Gardens are to be broken up, and the plants to be sent to the Horticultural, that is [if] they will accept of them, if not they are to be offered to persons belonging to Regent's Park."

Feb. 20. "I have the pleasure of informing you that all proceedings respecting Kew are put an end to."

Feb. 25. "Mr. Brown was here on Monday for three hours. He was quite outrageous. We must get out collectors, that would be the main point."

Mr. Brown's feeling was no doubt induced by the proposal to break up the collections.

Feb. 28. "I am happy to tell you that Kew is quite safe. It was never meant to be otherways. The offering of them to the Horticultural seems to have been for the want of better information on the subject by the gentleman who made the offer."

March 9. "You will not be a little surprised, and I think not less grateful, when I tell you your letter that you wrote me giving particulars of the origin of Kew Gardens, and the interest taken by the Princess of Saxe Gotha, that said letter went to the throne, and [was] read by Her Majesty and Prince Albert; they were much interested in it. There is no doubt that was the reason Lord Ilchester came to Kew, as he is one of Her Majesty's household."

It seems probable that after all the continued existence of Kew was rather due to the interest of the Sovereign than the influence of popular agitation.

SIR WILLIAM HOOKER.

Towards the end of the year, Mr. Aiton intimated his intention of resigning the charge of the Botanic Garden, having been nearly 50 years in the service. He appears not to have resigned the charge of the Pleasure Grounds till (1845) five years later. Sir William Hooker, F.R.S., then Regius Professor of Botany in the University of Glasgow, was appointed Director of the Botanic Garden, which then comprised only 15 acres, an insignificant area compared with the present establishment. "His duties commenced on the 1st of April 1841, from which "date commenced a new era in the history of the Royal Garden, Kew."

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX I.—1891.

LIST OF SEEDS OF HARDY HERBACEOUS PLANTS AND OF TREES AND SHRUBS.

The following is a list of such Hardy Herbaceous Annual and Perennial Plants as well as of such Trees and Shrubs as have matured seeds under cultivation in the Royal Gardens, Kew, during the year 1890. These seeds are available for exchange with Colonial, Indian, and Foreign Botanic Gardens, as well as with regular correspondents of Kew. The seeds are for the most part only available in moderate quantity, and are not sold to the general public.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
88 and 90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.
Price Twopence.

HERBACEOUS PLANTS.

Acæna argentea, Ruiz et Pavon, Chili.
microphylla, Hk. fil., N. Zealand.
myriophylla, Ldl., Chili.
ovalifolia, Ruiz et Pavon, Peru (Ancistrum repens, Vent.)
pinnatifida, R. & P., Chili.
sanguisorbæ, Vahl, New Zeal.

Acanthus longifolius, Host, S. Eur.

Achillea alpina, L., Alps.
Millefolium, L., Eur.
— var. rubrum.
Ptarmica, L., Eur.
setacea, W. & K., Eur.

Aconitum Fischeri, Rchb., Kamtsch.
— var. acutum.
heterophyllum, Wall, India.
Lycoctonum, L., Eur., etc.
— var. ochranthum.
— var. orientale, Hort.
Napellus, L., Eur., Temp. Asia.
— var. album.
volubile, Pall., Siberia.

Acroglochin chenopodioides, Schrad., W. Himal.

Actinolepis coronaria, Gray, Calif. (Hymenoxys californica, Hook. Bæria coronaria, Gray. Shortia californica, Hort.)

Actinomeris squarrosa, Nutt., N. Amer. (A. alternifolius, DC. A. helianthoides, Nutt.)

Adenophora liliifolia, Bess., Hungary, etc.
(A. suaveolens, Fisch.)

Adesmia muricata, DC., Chili, Patag.

Adlumia cirrhosa, Raf., Unit. States.

Adonis æstivalis, L., Eur.

Ægopogon pusillus, Beauv., Mexico.

Æthionema gracile, DC., Greece.
græcum, B.S., Greece.
heterocarpum, Gay, Syria.
saxatile, R.Br., S. Eur.

Ageratum conyzoides, L., N. Amer.

Agrimonia Eupatoria, L., Eur., etc.
odorata, Mill., Eur.
pilosa, Led., E. Eur.

Agropyrum junceum, Beauv., Eur., etc.
(T. junceum, L.)

Agrostis alba, L., Eur.
— var. stolonifera, (L.)
interrupta, L., S. Eur.
rubra, L., Norway, Sweden.
vulgaris, With., Eur.
— var. foliis variegatis.

Ajuga reptans, L., Eur.

Alchemilla alpina, L. Eur.
argentea, Don., Eur. (A. conjuncta, Bab.)
vulgaris, L., Eur.

Alisma Plantago, L., Eur.

Allium angulosum, L., Siberia.
— var. acutangulum, (Schrad.)
atropurpureum, W. et K., Hungary.
fistulosum, L., Siberia.
fragrans, Vent., N. America.
giganteum, Regel., Siber.
globosum, Redouté., S. E. Eur.
— var. albidum.
hymenorrhizum, Ledeb., Siberia.
— var. tenuifolium, Regl.
neapolitanum, Cyril., Italy, etc.

Allium—*cont.*
obliquum, L., Siberia.
odorum, L., Siberia.
polyphyllum, Kar. et Kir., Siberia.
Schœnoprasum, L., Eur.
— var. sibiricum, (L.)
Scordoprasum, L., Eur.
senescens, L., Eur., Siber.
siculum, Ucria., Sicily, etc.
sphærocephalum, L., Eur.
— var. Deseglesei, (Bor.)
subhirsutum, L., S. Eur., etc.
triquetrum, L., Eur.
ursinum, L., Eur.
Victorialis, L., Eur., Siber., etc.

Alonsoa acutifolia, R. et P., Peru.
caulialata, R.P., Peru.
grandiflora, Hort., Peru.
Warscewiczii, Rgl., Peru.

Alopecurus agrestis, L., Eur., Caucas.
geniculatus, L., Eur.
nigricans, Hornem., Eur.
pratensis, L., Eur.
— var. fol. variegatis.

Alstrœmeria aurantiaca, Don, Chili.
hæmantha, R. et P., Chili.
pulchra, Sims., Chili.

Althæa Kregujevacensis, Pancic., S. E. Eur.
multiflora, Reichb., Eur.
officinalis, L., Eur.
rosea, Cav., Orient.
— var.
— var. Heldreichii, (Boiss.)
sulphurea, Boiss. et H., Persia.

Alyssum argenteum, Vitm., Eur.
incanum, L., Eur.
libyca (R. Br.), Spain.
minimum, Willd., Eur.
pyrenaicum, Lap., Pyrenees.
rostratum, Stev., S. E. Eur.
saxatile, L., Russia.

Amaranthus chlorostachys, Willd., India.

Amaranthus—*cont.*
hypochondriacus, L., Amer., etc.
— var. caudatus, (L.)
— var. speciosus, (Don.)
margaritae, Hort.
paniculatus, L., India, etc.
retroflexus, L., Amer., etc.

Amblyolepis (*see* Helenium).

Amethystea cœrulea, L., Siber.

Ammi glaucifolium, L., S. Eur.

Ammobium alatum, R.Br., Australia.

Anacyclus radiatus, Loisl., Eur.

Anagallis arvensis, L., Eur., etc.
— var. carnea, (Schrank.)
— var. cœrulea, (Schreb.)
— var. Monellii, (L.)
— var. Phillipsii, Hort.

Androsace nana, Horn, Eur.

Anemone baldensis, L., Eur.
coronaria, L., S. Eur., etc.
decapetala, L., N. Amer.
multifida, Poir., N. Amer.
—var. Hudsoniana, (Richards.)
pennsylvanica, L., N. Amer.
Pulsatilla, L., Eur., etc.
rivularis, Buchan., Himal.
sylvestris, L., Eur.
virginiana, L., N. Amer.

Angelica dahurica, Benth. et Hook., Japan.
gingidium, Hook. f., New Zeal.

Anoda Wrightii, Gray, Mexico.

Antennaria dioica, Gærtn., Eur. etc.
— var. tomentosa.
margaritacea, R.Br., Eur.

Anthemis ætnensis, Schouw., Mt. Etna.
arvensis, L., Eur. Am.
Bourgœi, B. R., Spain.
Kitaibellii, Spr., Hungaria.
nobilis, L., Eur.
— var. discoidalis.
peregrina, Willd, S. Eur.
tinctoria, L., Eur.
— var. pallida.

Anthericum Liliago, L., S. Eur., N. Afr.
— var. algeriense, (Boiss.)
— var. Dorseti, Hort.
ramosum, L., Eur.

Anthoxanthum gracile, Biv., Sardinia, Crete, etc.
odoratum, L., Eur.
Puelii, Lecoq. et Lamotte, Eur.

Anthriscus Cerefolium, Hoffm., Eur.
sylvestris, Hoffm., Eur.
vulgaris, Pers., Eur.

Anthyllis tetraphylla, L., S. Eur.

Antirrhinum Asarina, L., Italy.
Orontium, L., Eur.
rupestre, Boiss. et Reut., Spain.

Apium graveolens, L., Eur., etc.

Aquilegia atrata, Koch., Alps, Eur.
Bertolonii, Schott., Ital.
chrysantha, Gray, N. Amer.
— var.
cœrulea, Torr., N. Amer.
cœrulea × chrysantha.
flavescens, S. Wats., Californ.
glandulosa, Fisch., Altai.
— var. parviflora, Regel.
Rauwolfii, Hort., var. aurea.
sibirica, Lam., Siberia.
— var. alba, Hort.
— var. Bungei, Hort.
vulgaris, L., Eur.
— var. Kitaibelii.
— var. monstrosa.

Arabis albida, Stev., Caucas.
— var.
alpina, L., Eur., N. Afr.
auriculata, Lam., S. Eur.
cenisia, Reichb., S. Eur.
Eschscholtziana, Andrz., Russia.
hirsuta, Scop., S. Eur.
lilacina, Schrad., N. Amer.
petræa, Crantz., Eur.
pumila, Jacq., S. Eur.
rosea, DC., Calabr.
Soyeri, B. et R., Pyrenees.
Stelleri, DC., China, etc. (A. japonica, Gray.)
stricta, Huds., Eur.
sudetica, Tausch., Centr. Eur.
Turczaninowii, Led., Siberia.

Archangelica littoralis, Agardh., Carpath.
officinalis, Hoffm., Eur.

Arctium majus, Schk., Eur.
— var. Kotschyi, Hort.

Arenaria balearica, L., Balearic Isles.
fasciculata, Gouan,) Eur. (Alsine Jacquinii, Koch.)
graminifolia, Schrad., S. Eur.
— var. multiflora.
— var. parviflora.
gypsophiloides, Schreb., Orient.
laricifolia, L., Eur.
pinifolia, Bbrst., Caucas.

Argemone hispida, Hook., Calif.
mexicana, L., Mexico.
— var. alba.

Armeria filicaulis, Boiss., Spain.
maritima, Willd., Eur.
— var. alba.
— var. Laucheana.
plantaginea, Willd., Eur.
— var. alba.
— var. leucantha, Boiss.
purpurea, Koch., Eur.
vulgaris, Willd., Eur.
— var. rubra.
Welwitschii, Boiss., Spain.

Arnica amplexicaulis, Nutt., N. Amer.
Chamissionis, Less., N. Amer.
montana, L., Eur.

Arrhenatherum avenaceum, Beauv., Eur.
bulbosum, Presl., S. Eur.

Artemisia annua, L., S. E. Eur.
discolor, Dougl., N. Amer.
glauca, Pall., S. Russia, Siberia.
— var. glabra, Besser, Siberia.
Messerschmidtiana, Besser, Siber.
parviflora, Roxb., India.
rupestris, L., Eur. Siber.
vulgaris, L., Eur.

Arum italicum, Mill., Eur.
maculatum, L., Eur.
orientale, Bbrst., Caucas, etc.

Asparagus officinalis, L., Eur.

Asperula azurea, Jaub. et Spach., Syria.
hexaphylla, All., Italy, etc.
longifolia, Sibth., Thrace, etc.
tinctoria, L., Eur.

Asphodelus albus, Willd., Eur.
ramosus, L., S. Eur.

Aster corymbosus, Ait., N. Amer.
lævis, L., N. Amer.
Linosyris, Bernh., Eur.
longifolius, Lam., N. Amer.
macrophyllus, L., N. Amer.
Novi-Belgii, L., N. Amer.
— var. densus, Hort., Kew.
— var. niveus, Hort., Kew.
patulus, Lam., N. Amer.
pseudo-amellus, Hk. fil., Himal., 13,000 ft.
puniceus, L., N. Amer.
— var. lucidulus, Gray. (A. vimineus, T. et Gr.)
pyrenaeus, Desf., Pyrenees.
Radula, Ait., N. Amer.
salicifolius, Ait., N. Amer.
— var.
Shortii, Hook., N. Amer.
trinervis, Desf., Eur.

Asterolinum stellatum, Link, Eur.

Astilbe rivularis, Don., E. Ind.

Astragalus aduncus, Willd., Caucas.
ægyptiacus, Spr., Egypt.
boeticus, L., Spain, Italy, etc.
chinensis, L., China.
chlorostachys, Ldl., Himal.
Cicer, L., Eur.
falcatus, Lam., Siberia.
frigidus, Gray, N. Amer.
glycyphyllus, L., Eur.
sulcatus, L., Siber., Taur.

Astrantia Biebersteinii, F. et M., Caucas.
helleborifolia, Salisb. Caucas. (A. maxima, Pall.)
major, L., Eur., etc.
— var. carinthiaca, (Hoppe.)

Athamanta cretensis, L., Eur.

Atriplex hortensis, L., N. Asia.
— var. rubra, Hort.
sibirica, L., Siberia (Obione sibirica, Fisch.)
tatarica, L., Eur. (A. oblongifolia, W. et K.)

Atropa Belladonna, L., Eur.

Aubrietia croatica, Schott., Croatia.
deltoidea, DC., S. Eur.
— var. antibilonica, Hort.
— var. Bougainvillea, Hort.
— var. græca, (Griseb.)
— var. grandiflora.
— var. Mooreana, Hort.
— var. purpurea.
— var. Richardi, Hort.
— var. taurica.
erubescens, Griseb., Greece.
gracilis, Sprun., Eur.

Avena canariensis, Nees., Teneriffe.
Notarisii, Hort.
pratensis, L., Eur. Siber. (A. bromoides, L.)
sativa, L., S. Eur.

Baeria chrysostoma, F. et M., Calif.
gracilis, Gray, W. Calif.

Bahia lanata, DC., N. Amer. (Eriophyllum cæspitosum, Dougl.)

Baptisia australis, R. Br., N. Amer.

Barbarea vulgaris, R. Br., Eur.
— var. variegata.

Beckmannia erucæformis, Host, Eur., etc.

Beta trigyna, W. et K., E. Eur.
vulgaris, L., Eur., Afr., etc.

Bidens humilis, H. B. K., Chili.
leucantha, Willd., N. Amer., etc.

Biserrula Pelecinus, L., S. Eur., etc.

Biscutella ciliata, DC., S. Eur.
didyma, L., S. Eur.
erigerifolia, DC., Spain.

Blitum (*see* Chenopodium).

Blumenbachia insignis, Schrad., Monte Video.

Bocconia cordata, W., China.

Boissiera Danthoniae, A. Br., S. Eur.

Boltonia latisquama, Gray, N. Amer.

Brachycome diversifolia, F. et M., Australia.

Brachypodium distachyum, R. et S., Medit.

Brassica alba, Boiss., Eur.
balearica, Rich., Ins. Balear.
campestris, L., Eur., etc. (B. chinensis, L.)
— var. cernua, (Thunb.)
— var. serotina.
— var. Shantung Cabbage.
Cheiranthus, Vill., S. Eur.
elata, Ball., N. Afr.
Eruca, L., S. Eur.
Erucastrum, Vill., S. Eur.
nigra, Koch, Eur.
oleracea, L., Eur.
— var. capitata.
— var. Jersey kale.
— var. violacea, Hort.
Pollichii, Shuttl.
quadrivalvis, Hk. f. et Th., India.
Rapa, L., Eur.
rugosa, Roxb., Thibet.
Tournefortii, Gouan, Spain, etc.

Braya alpina, Sternb., Alps.

Briza maxima, L., Eur.
minor, L., Eur.
rufibarbis, Hort.

Brodiæa peduncularis, Wats., Calif.

Bromus adœnsis, Hochst.
arvensis, L., Eur.
Biebersteinii, R. et S., Caucas.
breviaristatus, Thurb., N. Amer.
ciliatus, L., N. Amer. (B. canadensis, Michx., B. purgans, L.)
erectus, Huds., Eur., etc.
madritensis, L., Eur.
maximus, Desf., Eur.
— var. Gussonii, (Parl.)
mollis, L., Eur., etc.
— var. glabrescens, Coss.
patulus, Mert., Eur.
propendens, Jord., Eur.
racemosus, L., Eur.
Schraderi, Kunth., Amer.
sterilis, L., Eur.

Bromus—*cont.*
Taena, Steud., Chili.
tectorum, L., Eur., Asia.

Browallia viscosa, H.B.K., Peru.

Bryonia dioica, L., Eur.

Bunias orientalis, L., Orient.

Buphthalmum salicifolium, DC., Eur.
speciosum, Schreb., Eur.

Bupleurum longifolium, L., Temp., Eur.
rotundifolium, L., Eur.

Butomus umbellatus, L., Eur.

Calais (*see* Microseris).

Calamagrostis Epigeios, Roth, Eur.
lapponica, Trin., Eur.
varia, Trin., Eur., etc.

Calamintha Clinopodium, Bth., Eur.
grandiflora, Lam., S. Eur.

Calandrinia glauca, Schrad., Chili.
linearifolia, DC., N. Amer.
Menziesii, Hook., Oregon.

Calceolaria chelidonoides, H.B.K., Chili.

Calendula hybrida, L., S. Eur.
officinalis, L., S. Eur.

Calepina Corvini, Desv., S. Eur.

Calliopsis (*see* Coreopsis).

Callistephus chinensis, Nees., China.

Caltha palustris, L., Eur., etc.
— var. minor, Syme.
radicans, Forster, Eur., etc.

Camassia esculenta, Ldl., N. Amer.
Fraseri, Torr., N. Amer.

Camelina sativa, Crantz, Eur., etc.

Campanula alliariæfolia, Willd., Caucas.
bononiensis, L., Eur., etc.
carpathica, L. fil., Carpath.
— var. alba.
— var. turbinata, (Schott.)
collina, Bbrst., Caucas.
Erinus, L., Eur.
glomerata, L., Eur., etc.
Grossekii, Heuffel., Hungaria.

Campanula—*cont.*
lactiflora, Bbrst., Caucas.
— var. cœrulea.
latifolia, L., Eur., etc.
— var. macrantha, (Fisch.)
— var. versicolor, (Sib. et Sm.)
persicifolia, L., Eur., etc.
— var. alba.
— var. maxima.
rapunculoides, L., Eur.
Reuteriana, B. et B., Orient.
rhomboidea, L., Eur.
sibirica, L., Eur., Asia.
Trachelium, L., Eur.
vesula, All., Pedem.

Cannabis sativa, L.

Cardamine græca, L., Greece. (Pteroneuron græcum, DC.)
impatiens, L., Eur.
Ludoviciana, Hook., N. Amer.

Carduus stenolepis, (K. et K.), Siber.

Carex adusta, Boott, N. Amer.
alata, Torr., N. Amer.
crinita, Lam., N. Amer.
depauperata, Good., Eur.
distans, L., Eur.
divulsa, Good., Eur.
flava, L., Eur., etc.
— var. Oederi, (Ehrh.)
fulva, Good., Eur.
Grayii, Carey, N. Amer.
Heleonastes, Ehrh., Eur.
hordeiformis, Whlbrg., Eur. Cauc. (C. hordeistichos, Vill.)
lagopodioides, Schk., N. Amer.
leporina, L., Eur.
multiflora, Mhlbrg., N. Amer.
ornithopoda, Willd., Eur.
ovalis, Good., Eur.
pendula, Huds., Eur. (C. maxima, Scop.)
punctata, Gaud., Eur.
salina, Wahl., Eur.
— var. kattegatensis, (Fr.)
scirpoidea, Michx., N. Amer. (Wormskioldiana, Horn.)
sylvatica, Huds., Eur.
vulgaris, Fries, N. Amer., etc.
vulpina, L., Eur.

Carpoceras sibiricum, Boiss., Siber.

Carrichtera Vella, DC., Eur.

Carthamus lanatus, L., S. Eur.

Carum Carui, L., Eur.
rigidulum, Koch., Italy.

Castilleia indivisa, Eng., Amer.

Catananche lutea, L., Italy, etc.
— var. alba.

Cathcartia villosa, Hk. f., Himal.

Celsia cretica, L., Crete, N. Afr.
— var. grandiflora.

Centaurea calocephala, Willd., S. Eur.
Cyanus, L., Eur.
cynaroides (Less.), Pyrenees.
dealbata, Willd., Caucas.
helenifolia (G. et G.), S. Eur.
Jacea, L., Eur., etc.
montana, L., Eur.
— var. flore albo.
nigra, L., Eur.
obscura, Jord., Eur.
pulchra (F. et M.), Caucas.
rigidifolia, Bess, Caucas.
Scabiosa, L., Eur.
— var. alba.
— var. Olivieriana, (DC.)
— var. purpurea.
sonchifolia, L., Medit.

Cephalaria procera, Fisch. et Mey., Orient.
tatarica, Schrad., Siberia.

Cerastium arvense, L., Eur.
— var. grandiflorum.
chloræfolium, F. et M., Orient.
frigidum, Bbrst., Caucas.

Ceratocephalus (*see* Ranunculus).

Ceratochloa unioloides, DC., S. Eur. (Bromus unioloides, H.B.K.)

Cerinthe major, L., S. Eur.

Chænostoma fœtida, Benth., Cape.

Chærophyllum aromaticum, Jacq., S. Eur.

Chamæpeuce (*see* Cnicus).

Charieis heterophylla, Cass, Cape.
— var. rubra.

Cheiranthus Cheiri, L., Eur.

Chelidonium majus, L., Eur.
— var. fl. pl.
— var. laciniatum.

Chelone Lyoni, Pursh, N. Amer.

Chenopodium album, L., Eur.
Bonus-Henricus, L., Eur.
opulifolium, Schrad., Eur.
Quinoa, L., S. Amer., etc.
urbicum, L., Eur.
virgatum, Benth. et Hook., S. Eur. (Blitum virgatum, L.)

Chlora perfoliata, L., Eur.

Chloris barbata, Sw., Ind., etc.
elegans, H.B.K., Mexico.

Chorispora tenella, DC., Cauc., etc.

Chrysanthemum achilleæfolium, Bbrst., Cauc. (Pyrethrum achilleæfolium Bbrst.)
Balsamita, L., Orient.
— var. tomentosum.
carinatum, Schousb., N. Afr.
cinerariæfolium, Vis., Dalmatia. (Pyrethrum cinerariæfolium, Trev.)
coronarium, L., S. Eur.
— var. album.
— var. fl. pl.
corymbosum, L., Eur. (Pyrethrum Clusii, Fisch.)
latifolium, Willd., Eur. (L. latifolium, DC.)
maximum, DC., Pyrenees.
macrophyllum, W. et K., Eur. (Pyrethrum macrophyllum, Willd.)
multicaule, Desf., N. Afr.
Parthenifolium, Pers., Eur. (Pyrethrum parthenifolium, Willd.)
— var.
roseum, Adams, Caucas. (P. roseum, Bbrst.)
segetum, L., Eur.
Tchihatcheffii (Regel), Siber. (Pyrethrum.)
uliginosum, Pers., Hungary.
viscosum, Desf., Spain.

Chrysogonum virginianum, L., N. Amer.

Cichorium Intybus, L., Eur.

Cimicifuga racemosa, Nutt., N. Amer.

Cinna mexicana, Beauv., Mexico.

Circaea lutetiana, L., Eur., etc.

Cirsium (*see* Cnicus).

Cistus platysepalus, Sweet.

Clarkia elegans, Lindl., Calif.
pulchella, Pursh, N. Amer.
— var. alba.

Claytonia perfoliata, Don., N. Amer.
sibirica, L., N. Amer. (C. alsinoides, Sims.)

Clematis integrifolia, L., S. Eur.
montana, Ham., Himalayas.
ochroleuca, Ait., N. Amer.
orientalis, L., Temp. Asia.
— var. graveolens, Lindl.
recta, L., Eur., etc.
— var. hispanica, Hort.
— var. pauciflora.
Viorna, L., N. Amer.
— var. coccinea, James.

Clintonia (*see* Downingia).

Cnicus altissimus, Willd., N. Amer.
diacanthus, Desf., S. Eur.
fimbriatus, Bieb., Taurus.
flavispinus, Ball, Morocco.
heterophyllus, Willd., Eur. (Cirsium heterophyllum, All.)
Kotschyi, Schultz.
lanceolatus, Willd., Eur.
strictus, Tenore, Italy, etc. (Chamæpeuce stricta, DC.)
syriacus, Willd., Medit.

Cochlearia danica, L., Eur.
glastifolia, L., S. Eur.
officinalis, L., Eur.
— var. alpina, Wats.

Colchicum byzantinum, Ker., Transyl.
speciosum, Stev., Caucas.

Collinsia bicolor, Benth., Calif.
— var. multicolor.
grandiflora, Dougl., N. Amer.
parviflora, Dougl., N. Amer.

Collomia coccinea, Lehm., Chili.
gilioides, Benth., Calif.
grandiflora, Dougl., Calif.
linearis, Nutt., Calif.

Conioselinum Fischeri, Wimm. et Grab., Siber.

Conringia perfoliata, Link, Eur.

Convallaria majalis, L., Eur., Amer.
— var. major.
— var. rosea.

Convolvulus tricolor, L., Medit.
undulatus, Cav., Medit.

Coreopsis coronata, Hook., E. Texas.
Douglasii, B. et H., Calif. (Leptosyne Douglasii, DC.)
maritima, Hook., Calif. (Leptosyne maritima, Gray.)
lanceolata, L., N. Amer.
— var. villosa, Michx.
tinctoria, Nutt., N. Amer.
— var. bicolor.
trichosperma, Michx., Amer.
verticillata, L., N. Amer.

Coriandrum sativum, L., Eur., etc.

Corispermum hyssopifolium, L., S. Eur.

Cortusa Matthioli, L., Eur.
— var. grandiflora.

Corydalis capnoides, Pers., S. Eur.
glauca, Pursh., Unit. States.
lutea, DC., S. Eur.
nobilis, Pers., Siber.
ophiocarpa, Hk. f. et Th., China.

Cosmidium Burridgeanum, Hort. (Thelesperma filifolium × Coreopsis tinctoria.)

Cotula coronopifolia, L., Eur.
filicula, Hk. fil., Australia.
matricarioides, Bong., Kamtsch.

Crepis aculeata, DC., Eur.
biennis, L., Eur.
Candollei, Spr., Eur.
hyoseridifolia, Tausch., Eur.
pulchra, L., Eur.
rubra, L., S. Eur.
tectorum, L. fil., Eur., Siberia.

Crinum capense, Herb., Cape.
— var. riparium, Herb.

Crocus äerius, Herb., Armenia.
aureus, Sm., S. Eur.
asturicus, Herb., Spain.
Balansae, Gay., As. Minor.
bannaticus, Heuffel, Transylvania.
biflorus, Mill., Tuscany, etc.
— var. Pestalozzæ, Boiss.
— var. Weldeni, Gay.
cancellatus, Herb., Ionian Isles.
chrysanthus, Herb., As. Minor.
Clusii, Gay, Portugal.
corsicus, Maw, Corsica.
dalmaticus, Vis., Dalmatia.
etruscus, Parl., Tuscany.
Imperati, Ten., Italy.
Korolkowii, Regel. et Maw., Turkestan.
lævigatus, Bory. et Chamb., Greece.
medius, Balbis, Riviera.
pulchellus, Herb., Turkey.
reticulatus, Bbrst., Caucas, etc.
Salzmanni, Gay., Morocco.
sativus, L., Cult.
— var. Cartwrightianus, Herb.
— var. Elwesii, Maw.
Sieberi, Gay, Greece, etc.
speciosus, Bbrst., Caucas., etc.
suaveolens, Bert., C. Italy.
Tommasinianus, Herb., Dalmat.
vernus, All., C. Eur.
— var. albiflorus, Gay.
zonatus, Gay, Cilicia.

Crucianella
ægyptiaca, L., Egypt.
græca, Boiss., S. Eur.

Cryptostemma calendulaceum, R.Br., Cape.

Cucubalus baccifer, L., Eur.

Cuphea lanceolata, Ait., Mexico.
(C. silenoides, Nees.)
viscosissima, Jacq., Amer.
Zimapani, Roezl, Mexico.
(C. silenoides, var. Zimapani, Hort.)

Cyananthus lobatus, Wall., Himal.

Cynodon Dactylon, L., Cosmop.

Cynoglossum furcatum, Wall., Ind.
micranthum, Desf., China.
officinale, L., Eur.
pictum, Ait., S. Eur.

Cynosurus cristatus, L., Eur.
elegans, Desf., S. Eur.

Cysticapnos africanus, Gærtn., Cape.

Cyzackia Liliastrum, Andrz., S. Eur.

Dactylis glomerata, L., Eur., etc.

Dahlia coccinea, Cav., Mexico.
(D. Cervantesii, Lag.)
Merckii, Lehm., Mexico.
variabilis, Desf., Mexico.

Datura fastuosa, L., S. Amer.
— var. rubra.
ferox, L., Ind., China.
lævis, L. fil., Africa.
Stramonium, L., Eur.
Tatula, L., Eur., etc.
— var. gigantea.

Daucus Carota, L., Eur., etc.
hispidus, Desf., Eur., N. Afr.

Delphinium Ajacis, Reichb., S. Eur.
azureum, Michx., N. Amer.
Brunonianum, Royle., Himal.
caucasicum, L., Caucas.
cheilanthum, Fisch., Siberia.
— var. bifidum.
— var. elongatum.
crassifolium, Schrad., Cauc.
dictyocarpum, DC., Siberia.
elatum, L., Eur., etc.
— garden varieties.
— var. intermedium.
formosum, Hort.
grandiflorum, L., China, etc.
(D. chinense, Fisch.)
— var.
Kashmirianum, Royle., Himal.
nudicaule, Torr. et Gr., Calif.

Delphinium—*cont.*
triste, Fisch., Siberia.
trolliifolium, Gray., Amer.
vestitum, Wall., Himal.

Deschampsia cæspitosa, Beauv., Eur. (Aira cæspitosa, L.)
— var. vivipara.
flexuosa, Trin., Eur. (Aira flexuosa, L.)

Desmodium canadense, DC., N. Amer.

Dianthus arenarius, L., Eur.
atrorubens, All., Eur.
barbatus, L., Eur.
Caryophyllus, L., Eur.
cæsius, Sm., Eur.
— var.
calocephalus, Boiss., Greece.
deltoideus, L., Eur.
fimbriatus, Bbrst., Orient.
fragrans, Bbrst., Caucas.
plumarius, L., Eur.
— var. albus.
— var. serotinus.
prolifer, L., Eur.
pulchellus, Pers., Eur.
Requienii, G. et G., S. Eur.
Seguieri, Vill., Eur.
tener, Balb., Eur.

Diarrhena americana, Beauv., Amer.

Dictamnus albus, L., W. Eur., Jap.
(D. Fraxinella, Pers.)
— var. purpureus.

Digitalis ambigua, Murr., (D. grandiflora, Lam., D. ochroleuca, Jacq.), Eur.
lutea, L., Eur.
purpurea, L., Eur.
— var. alba, Hort.

Digitaria ciliaris, Pers., Cosmopol.

Dimorphotheca annua, Less., Cape.
(Calendula pluvialis, L.)

Dioscorea japonica, Thunb., Japan.
pyrenaica, Bub. et Bord., Pyren.

Diphylleia cymosa, Michx., N. Amer.

Diplotaxis erucoides, DC., Mediter.
tenuifolia, DC., Eur.

Dipsacus asper, Wall., Himal.
ferox, Loisl., Corsica.
sylvestris, L., Eur.

Dischisma arenarium, C. A. Mey., Cape.

Dodecatheon Meadia, L., N. Amer.
— var. splendidum.

Doronicum Pardalianches, L., Eur.
— var. glabrum, Hort.
— var. grandiflorum.
— var. minor.

Dorycnium ibericum, Willd., Caucas., etc.

Downingia elegans, Torr., Calif.

Draba aizoides, L., Eur.
borealis, DC., Isl. of St. Paul.
carinthiaca, Hopp., Eur.
frigida, Saut., Alps, Eur.
hirta, L., N. Eur.
hispanica, Boiss., Spain.
incana, L., Eur.
— var. contorta.
— var. stylaris, (Gay.)
lasiocarpa, Reichb., S. Eur.
laxa, Lindlb., Eur.
Traunsteineri, Hopp., Eur.
verna, L., Eur., N. Amer.

Dracocephalum Moldavica, L., Siber., etc.
parviflorum, Nutt., N. Amer.

Drusa oppositifolia, DC., Teneriffe.

Dryas octopetala, L., Eur., Amer.

Echinops ruthenicus, Reichb., S. Eur.
— var.
sphærocephalus, L., Eur.

Elsholtzia cristata, Willd., S. Eur.

Elymus canadensis, L., N. Amer.
— var. glaucifolius, Gray.
sabulosus, Bbrst., Tauria.
sibiricus, L., Siber.

Emilia sagittata, DC., India.
(Cacalia coccinea, Sims.)

Emex spinosa, Camb., S. Eur.

Encelia subaristata, Gray., N. Amer.

Epilobium alpestre, Jacq., Eur.
alsinefolium, Vill., Eur.
angustifolium, L., Eur.

Epilobium—*cont.*
angustifolium, var. album.
— var. major.
Billardierianum, Sering., N. Zeal.
hirsutum, L., Eur.
Lamyi, Schultz, S. Eur.
nummulariæfolium, A. Cunn., N. Zeal.
— var. pedunculare, Cunn.
rosmarinifolium, Hænke, Eur.
— var. sericeum.
tetragonum, L., Eur.

Eranthis hyemalis, Salisb., Eur.

Eremurus altaicus, Stev., Caucas.

Erigeron aurantiacus, Regel., Turkestan.
bellidifolius, Muhl., N. Amer.
glabellus, Nutt., N. Amer.
macranthus, Nutt., N. Amer.
mucronatus, DC., Mexico.
philadelphicus, L., N. Amer.
strigosus, Muhl., N. Amer.

Erinus alpinus, L., Eur.
— albus.

Eriosynaphe tortuosa, Fisch. et Mey., Siber.

Eritrichium strictum, Dcne., Himal.

Erodium cicutarium, L'Herit., Eur.
macradenium, L'Herit., Alps.
moschatum, L'Her., Eur.
trichomanefolium, L'Herit., Leban.

Ervum Lens, L., Eur., etc.

Eryngium Bourgati, Gouan, Pyren., etc.
giganteum, Bbrst., Caucas.
macrocalyx, Schr., Songaria.
maritimum, L., Eur.
Olivieranum, Delar. Caucas.
planum, L., S. Eur., etc.
rigidum, Lam., S. Eur.
Serra, Chmss., Brasil.

Erysimum aureum, Bieb., S. Russia.
græcum, Boiss. et Held., Oriens.
Marshallianum, Andrz., Siber.
Perowskianum, Fisch. et Mey., Caucas.
rupestre, DC., Asia Minor.

Erythræa diffusa, Woods, Azores.

Eschscholtzia californica, Cham., Calif.
— var. alba.
— cæspitosa, Brewer.
(E. tenuifolia, Bth.)

Eucharidium concinnum, F. et M., Calif.
— var. grandiflorum.

Eupatorium ageratoides, L., N. Amer. (E. Fraseri, Hort.)
cannabinum, L., Eur., Cauc.
purpureum, L., N. Amer.

Euphorbia exigua, L., Eur.
heterophylla, L., Ind., etc.
Lagascæ, Spr., Spain.
medicaginea, Boiss., Spain.
Myrsinites, L., Eur.
palustris, L., Eur.
Schimperiana, Hochst., Abyss.

Fagopyrum tataricum, Gaertn., Ind.

Ferula communis, L., Eur.
Ferulago, L., S. Eur., N. Afr.
gigantea, Horn., S. Eur.
glauca, L., S. Eur.
Linkii, Web., Ins. Canaries.
tingitana, L., N. Afr.

Festuca arundinacea, Schreb., Eur.
(F. decolorans, Mert.)
capillifolia, Duf., Spain.
ciliata, Danth., S. Eur.
(Vulpia ciliata, Link.)
Drymeja, Mert., Eur.
duriuscula, L., Eur., Amer.
elatior, L., Eur., etc.
— var. pratensis, (Huds.)
Halleri, All., S. Eur.
Myurus, L., Eur. (Vulpia Myurus, Gmel.)
ovina, L., Eur.
Poa, Kunth., S. Eur.
rigida, Kunth, Eur. (Sclerochloa rigida, Panzer.)
rubra, L., Eur.
sciuroides, Roth, Eur. (Vulpia bromoides, Link, F. bromoides, L.)
scoparia, Kern., Pyren.

Fœniculum vulgare, Gaertn., Eur.

Forskohlea tenacissima, L., Egypt.

Francoa appendiculata, Cav., Chili.
ramosa, Cav., Chili.
(F. picturata, Van Houtte.)
sonchifolia, Cav., Chili.

Fritillaria Meleagris, L., Eur.
— var. alba.
pontica, Wahl., Bithynia.
tenella, Bbrst., Caucas.

Fumaria capreolata, L., Medit. Region.
densiflora, DC., Eur.
— var. (micrantha, Lag.)
major, Bad., Eur. (F. media, DC.)

Funkia lancifolia, Spr., Japan.
— var. albo-marginata, Hort.
— var. undulata, Otto.
ovata, Spr., Japan.
Sieboldiana, Lodd., Japan.
subcordata, Spr., Japan.
(F. grandiflora.)

Gaillardia pulchella, Foug., N. Amer.
— var. grandiflora.

Galatella (*see* Aster).

Galax aphylla, L., N. Amer.

Galega orientalis, Lam., Orient.
— var.

Galeopsis pyrenaica, Bartl., Pyren.

Galinsoga brachystephana, Regel., S. Amer.
parviflora, Cav., Amer.

Galium Mollugo, L., Eur.
parisiense, L., Eur.
— var. leiocarpum.
recurvum, Reg., Greece.
rubrum, Scop., S. Eur.
saccharatum, All., Eur.
tenuissimum, Bbrst., Cauc.
tricorne, With., Eur.
tyrolense, Willd., Tyrol.
uliginosum, L., Eur.
verum, L., Eur.

Gastridium triaristatum, Dur. Algeria.

Gaura Lindheimeri, Eng. et. Gray., Amer.
parviflora, Dougl., N. Amer.

Gentiana asclepiadea, L., S. Eur.
— var. alba.
cruciata, L., Eur. Siber.
lutea, L., Eur.
septemfida. Pall., Caucas. (G. gelida, Hort.)
— var. cordifolia, Hk. f.
tibetica, King, Himal. (G. macrophylla, Hort.)
verna, L., Eur.

Geranium albiflorum, Ledeb., Siber.
armenum, Boiss., Orient.
cristatum, Steven., Caucas.
Endressi, Gay, Pyrenees.
gracile, Schrad., Siberia.
Londesii, Fisch., Siberia, etc.
lucidum, L., Eur.
molle, L., Eur.
rotundifolium, L., Eur.
sanguineum, L., Eur.
striatum, L., Italy.
sylvaticum, L., Eur.

Gerbera anandria, Schultz., China, Japan.

Geum atlanticum, Desf., N. Afr.
chilœnse, Balb., Chili.
— var. grandiflorum, Ldl.
heterocarpum, Boiss., Spain.
hispidum, Fr., Spain.
macrophyllum, Willd., Siber.
montanum, L., Alps, Eur.
parviflorum, Comm., N. Zeal.
pyrenaicum, Ram., Pyrenees.
rivale, L., Eur.
triflorum, Pursh., N. Amer. (Sieversia triflora, Spr.)
urbanum, L., Eur., etc.

Gilia achilleæfolia, Bth., Calif.
androsacea, Steud., Calif. (Leptosiphon androsaceus, Bth.)
capitata, Dougl., Calif.
inconspicua, Dougl., Calif.
laciniata, R. et P., Chili, Peru.
micrantha, Steud., Calif. (L. luteus, Benth.)
squarrosa, Hook. et Arn., Amer.
tricolor, Benth., Calif.
— var. alba.

Gladiolus segetum, Gawl., S. Eur.

Glaucium corniculatum, Curt., S. Eur.
— var. rubrum, Hort.
flavum, Crantz., Eur. (G. luteum, Scop.).

Globularia trichosantha, Fisch. et Mey., Orient.

Glyceria elongata, Trin., N. Amer.
maritima, Wahl., Eur.
remota, Fr. Eur. (G. norvegica, Smf.)

Gnaphalium indicum, L., India.

Godetia (*see* Œnothera).

Gypsophila paniculata, L., Siberia.
Rokejeka, Del., Egypt.

Hablitzia tamnoides, Bbrst., Caucas.

Hebenstreitia dentata, Thunb., Cape.
tenuifolia, Schrad., Cape.

Hedypnois (*see* Rhagadiolus).

Hedysarum boreale, Nutt., N. Amer.
flavescens, Regel. et Schmidt, Turkestan.
microcalyx, Baker, Himal.
obscurum, L., Eur.

Helenium autumnale, L., N. Amer.
— var. pumilum, Gray.

Helianthemum ægyptiacum, Mill., Egypt, etc.
polifolium, Mill., Eur.
vulgare, Gærtn., Eur.
— var.
— var. roseum, DC.
— var. rhodanthum, (Dunal.)
— var. tomentosum, (Dunal.)

Helianthus annuus, L., N. Amer.
decapetalus, L., N. Amer.
— var. ? multiflorus, Gray.
giganteus, L., N. Amer.

Helichrysum bracteatum, Willd., Austral.
— var. album.
— var. luteum.
orientale, DC., Orient.

Heliophila amplexicaulis, L. fil., Cape.
araboides, Sims, Cape. (H. pilosa, Lam.)
crithmifolia, Willd., Cape.

Heliopsis lævis, Pers., N. Amer.
— var. grandiflora.

Helipterum Manglesii, Bth., Austral.
(Rhodanthe Manglesii, Ldl.)
Milleri, Hort., Australia.
roseum, Benth., Australia.
(Acroclinium roseum, Hk.)

Helleborus, fœtidus, L., Eur., etc.
guttatus × colchicus, hybrid.
intermedius, Guss., Calabria.

Helonias bullata, L., N. Amer.
— var. latifolia.

Hemerocallis Dumortieri, Morren. Japan (H. Sieboldii, Hort.)
flava, L., S. Eur.
fulva, L., S. Eur., etc.
— var. Kwanso, Regel.

Heracleum Panaces, L., S. Eur.
pubescens, Bbrst., Cauc., etc.
— var. gummiferum, (Willd.)
Sprengelianum, W.A., Ind. Or.
villosum, Fisch., Russia.
— var. giganteum, Hort.

Herniaria hirsuta, L., Eur.

Hesperis matronalis, L., Eur., Siber.

Heuchera americana, L., N. Amer.
cylindrica, Dougl., N. Amer.
Drummondi, Hort.
hispida, Pursh, N. Amer.
(H. Richardsonii, R. Br.)
pilosissima, F. et M., N. Amer.
pubescens, Pursh, N. Amer.
ribifolia, J. et L., N. Amer.

Hibiscus Trionum, L., Cosmopol.
(H. africanum, Hort.)

Hieracium amplexicaule, L., Eur.
aurantiacum, L., Eur.
auricula, L., Eur.
flexuosum, W. et K., Eur.
lapsanoides, Lap., Pyrenees.
maculatum, Sm., Eur.
— var. Moëanum, Lindeb., Norway.
Pilosella, L., Eur.
pratense, Tausch., Eur.
prenanthoides, Vill., Eur.
— var. riphæum, Uechtr.
saxatile, Jacq., S. Eur.

Hieracium—*cont.*
stoloniflorum, W. et K., S. Eur.
villosum, L., Eur.
vulgatum, Fries, Eur.

Hierochloe borealis, Roem. et Schult., Eur.

Holcus lanatus, L., Eur.
mollis, L., Eur.
— var. variegatus.

Homogyne alpina, Cass., Eur.

Hoteia (*see* Astilbe).

Humulus japonicus, S. et Z., Japan.

Hunnemannia fumariæfolia, Sw., Amer.

Hutchinsia gracilis, Hort.

Hyacinthus amethystinus, L., Spain.
dubius, Guss., S. Eur.
romanus, L., S. Eur., etc.
(Bellevalia romana, Reichb.)

Hydrophyllum canadense, L., N. Amer.
virginicum, L., N. Amer.

Hymenophysa pubescens, Meyer., Siber.

Hyoscyamus aureus, L., S. Eur.
niger, L., Eur.
— var. albus, Hort.
orientalis, Bbrst., Cauc.

Hypecoum procumbens, L., S. Eur.

Hypericum elatum, Ait., N. Amer.
perforatum, L., Eur., China.

Hypochæris ætnensis, Ces. et Pass., Medit.
(Metabasis ætnensis, DC.)
arachnoidea, Poir., N. Afr.

Iberis amara, L., Eur.
ciliata, All., Alp. Marit.
Garrexiana, All., Pyrenees.
Lagascana, DC., Spain.
pectinata, Boiss., Spain.
sempervirens, L., Eur.
umbellata, L., S. Eur.
— var. carnea.

Impatiens parviflora, DC., Siberia, etc.
Roylei, Walp., Himal.

Impatiens—*cont.*
Roylei, var.
scabrida, DC., Ind.

Inula bifrons, L., Eur.
Bubonium, Jacq., Eur., etc.
grandiflora, Willd., Caucas., etc.
glandulosa, Willd., Caucas.
graveolens, Desf., Eur.
Helenium, L., Eur.
Hookeri, Clarke, Himal.

Ionopsidium acaule, Rchb., Eur.

Iris Fieberi, Seidl., Eur.
graminea, L., Eur.
— var. latifolia, Spach., France.
hybrida, Retz., Hort.
(amœna, DC.)
longipetala, Herb., Calif.
neglecta, Horn., Eur., *vars.*
Pseudacorus, L., Eur., etc.
— var. acoriformis, (Bor.)
— var. Bastardi, (Bor.)
setosa, Pallas, Siberia.
— var. atropurpurea.
sibirica, L., Eur., Siberia.
— var. acuta, (Willd.)
— var. alba, Hort.
spuria, L., Cent. Eur., etc.
— var. desertorum, (Ker.)
— var. notha, (Bbrst.)
— var. sogdiana, Baker., Cent. Asia.
Statellæ, Todaro, Eur.
Tolmiean, L., N. Amer.
Xiphium, Jacq., N. Spain.
(I. pyrenaica, Bub.)

Isatis tinctoria, L., Eur., etc.

Isopyrum fumarioides, L., S. Eur.
Iva xanthiifolia, Nutt., N. Amer.
(Cyclachæna xanthiifolia, Fres.)

Jasione montana, L., Eur.

Juncus Chamissonis, Benth., S. Amer.
compressus, Jacq., Eur.
lamprocarpus, Ehrh., Eur.
platycaulis, H. B.K.S., Amer.
supinus, Mœnch., Eur.
tenuis, Willd., Eur.

Knautia (*see* Scabiosa).

Kniphofia aloides, Moench., Cape.
— var. grandis.
— var. longiscapa.
corallina, Garden hybrid.
Macowani, Baker, Cape.

Kœleria cristata, Pers., Eur.

Kœlpinia (*see* Rhagadiolus).

Lactuca angustana, All., S. Eur.
flavida, Jord., S. Eur.
lactucaria, Jacq., Eur.
Plumieri, Gren. et Godr., S. Eur.
sativa, L., Eur., Cult.
Scariola, L., Eur.
undulata, Ledeb., Siberia.
virosa, L., Eur.

Lallemantia peltata, Fisch. et Mey., Caucas.
Royleana, Bth., Turkest., etc.

Laportea canadensis, Gaud., N. Amer.

Lasthenia glaberrima, DC., Amer.

Lathyrus angulatus, L., S. Eur.
Aphaca, L., Eur.
articulatus, L., S. Eur.
aureus, Benth. et Hook., Taur.
(Orobus aureus, Stev.)
Clymenum, L., S. Eur.
(O. Jordani, Tenore.)
filiformis, Lam., S. Eur.
lathyroides, B. et H., Siber.
(O. lathyroides, L.)
luteus, B. et Hk. f., Eur., etc.
(Orobus luteus, L.)
macrorrhizus, Wimm., Eur.
niger, Wimm., Eur.
(O. niger, L.)
Ochrus, L., Eur.
pratensis, L., Eur.
pisiformis, L., Siberia, etc.
rotundifolius, Willd., Caucas.
sativus, L., Eur.
— var. albus.
sphæricus, Retz., Eur.
tenuifolius, Desf., Eur., etc.
tingitanus, L., N. Afr.
— var. atropurpureus.
variegatus, B. et H., Pyrenees.
(O. variegatus, Lap.)
varius, B. et H., S. Eur.
(O. varius, Sims.)
venosus, Muhl., N. Amer.
— var.

Lavatera behriana, Schl., N. Zeal.
thuringiaca, L., Eur., etc.
trimestris, L., Medit.
— var. alba.

Layia Calliglossa, Gray., Calif.
glandulosa, Hk. et Arn., Calif., etc.
heterotricha, Gray, Calif. (Callichroa platyglossa, Fisch. et Mey.)

Leonurus Cardiaca, L., Eur.
sibiricus, L., Siber. China.

Lepidium incisum, Roth, Eur.
Menziesii, DC., N. Amer.

Leptosiphon (*see* Gilia).

Leptosyne (*see* Coreopsis).

Leucoium æstivum, L., Eur., etc.

Libanotis montana, Crantz, Eur.
sibirica, Koch., Eur., etc.

Ligularia (*see* Senecio).

Ligusticum scoticum, L., Eur. (Haloscias scoticus.)
Seguieri, Koch., S. Eur.

Limnanthes Douglasii, R. Br., Amer.
— var. grandiflora.

Linaria anticaria, Boiss., Spain.
bipartita, Willd., N. Afr.
— var. versicolor, Hort., Kew.
Broussonetii, Poir., Orient.
minor, Desf., Eur., N. Afr.
multicaulis, Desf., Ital.
— var. multipunctata, Steud.
prætermissa, Delas., France.
purpurea, L., Eur., etc.
repens, Mill., Eur.
reticulata, Desf., N. Afr.
— var. purpurea.
spartea, Hoffm., S. Eur.
triphylla, Willd., S. Eur.
tristis, Mill., S. Eur.
vulgaris, Mill., Eur.

Lindelofia spectabilis, Lehm., Himal.

Linum africanum, L., Afr.
alpinum, L., Eur. (L. Leonii, Schultz.)
angustifolium, L., Eur.

Linum—*cont.*
corymbiferum, Desf., Atlas.
maritimum, L., Eur.
perenne, L., Eur., etc.
— Lewisii, (Mhlbrg.)
usitatissimum, L., Eur.

Lithospermum latifolium, Michx., N. Amer.

Loasa prostrata, Gill., Chili.
volcanica, Andr., New Gren. (L. Wallisii, Hort.)

Lobelia decumbens, Rich.,
Erinus, L. Cape.
inflata, L., N. Amer.

Lolium linicolum, Sonder.
perenne, L., Eur.
— var. italicum, (Braun.)
temulentum, L., Eur.

Lonas inodora Gærtn., Sicily. (Athanasia annua, L.)

Lopezia coronata, Andr., Mexico. (L. minuta, Hort.)

Lophanthus anisatus, Bth., N. Amer.

Lophospermum scandens, Don., Mexico.

Lotus corniculatus, L., Eur.
major, Scop., Eur.
ornithopodioides, L., Eur.
tenuis, W. et K., Eur., etc.

Lunaria annua, L., Eur.
rediviva, L., S. Eur.

Lupinus angustifolius, L., S. Eur.
— var. macrocarpus, Hort.
arboreus, Sims, N. Amer.
— var.
Cosentini, Guss., Greece, etc.
elegans, H. B. K., Mexico.
Hilariensis, Benth., Brazil.
luteus, L., France, etc.
micranthus, Dougl., N. Amer.
nootkatensis, Don, N. Amer.
polyphyllus, Ldl., N. Amer.
— var.
— var. densus.
pubescens, Benth., N. Amer.
recurvatus, Meyen., Chili.
tricolor, Hort.
varius, L., Eur.

Luzula angustifolia, Poir., Carolina.
campestris, DC., Eur.
nivea, Desv., Alps, etc.
spicata, DC., Eur.

Lychnis alba, Mill., Eur.
(L. vespertina, Sibth.)
alpina, L., Eur.
chalcedonica, L., E. Eur., etc.
— var. alba.
Coronaria, Desv., S. Eur.
Coronaria × Flos-jovis, Hort.
corsica, Loisel., Eur.
diurna, Sibth., Eur.
diurna × alba, Hort.
Flos-jovis, Desv., S. Eur.
Githago, Lam., Eur. (Agrostemma Githago, L.)
Haageana, Lemaire, Japan.
— var. hybrida.
— var. nana.
læta, Ait., S. Eur., etc.
oculata, Ldl., Levant.
— var. elegans.
Viscaria, L., Eur.
— var. alba.

Lycopersicum esculentum, Mill., S. Amer.

Lycopus exaltatus, L. fil., Eur., etc.

Lysimachia ciliata, L., N. Amer.
davurica, Willd., Davuria.
Ephemerum, L., France, etc.
punctata, L., Eur.
vulgaris, L., Eur.

Lythrum Salicaria, L., Eur.
— var. roseum.
— var. tomentosum, (Mill.)
virgatum, L., Eur.

Madia sativa, Molina., Oregon, Calif.

Malcolmia africana, R.Br., S. Eur., N. Afr.
Chia, DC., Greece.
littorea, R.Br., S. Eur.
maritima, R.Br., S. Eur., etc.
mongolica, Max., Mongol.

Malope trifida, Cav., N. Afr.
— var. alba.

Malva Alcea, L., Eur.
— var. Morenii, (Poll.)
cretica, Cav., S. Eur.
crispa, L.
Duriæi, Spach., Eur.

Malva—*cont.*
moschata, L., Eur.
oxyloba, Boiss., Oriens.
parviflora, L., Eur.
rotundifolia, L., Eur.
sylvestris, L., Eur., etc.
— var. alba.
verticillata, L., Eur.
(M. glomerata, Hort.)

Malvastrum limense (L.), Chili.

Mandragora vernalis, Bert., Orient.

Marrubium peregrinum, L., Eur.
— var. remotum, Hort.
vulgare, L. Eur.

Matricaria callosa, Sch., Eur.
caucasica, Benth., Caucas.
(Pyrethrum caucasicum, Willd.)
inodora, L., Eur.

Meconopsis cambrica, Vig., Eur.
Wallichiana, Hook, Himal.

Medicago apiculata, W., Eur.
(Berteroana, Mor.)
Aschersoniana, Urban, N. Afr.
ciliaris, Willd., Eur.
(M. intexta, Willd.)
denticulata, Willd., Eur.
Echinus, DC., S. Eur.
Hornemanniana, Pers., Eur.
lappacea, Desr., S. Eur.
lupulina, L., Eur.
murex, Willd., Eur.
muricata, All, Eur.
orbicularis, Wilid., S. Eur.
rigidula, Lam., S. Eur.
(M. Gerardi, Kit.)
sativa, L., Eur.
Terebellum, Willd., S. Eur.
tribuloides, Lam., S. France.
— var. truncatula, Gaert.

Megacaryon avmenum, Boiss., Oriens.

Melica altissima, L., S. Eur., Cauc., etc.
ciliata, L., Eur., etc.
— var. Cupani, (Guss.)
— var. Magnolii, (G. et G.)
— var. penicillaris, (Boiss.)
nutans, L., Eur.
uniflora, Retz., Eur.

Melilotus alba, Desr., Eur.
officinalis, Desr., Eur.
parviflora, Lam., Eur.
(M. indica, All.)

Melissa officinalis, L., Eur., etc.

Mentha rotundifolia, L., Eur.
sylvestris, L., Eur.
— var. candicans, Reichb., Eur.
— var. umbrosa, Opiz.
viridis, L., Eur.
— var. crispa, Hook.

Mentzelia Lindleyi, T. et G., Calif.

Mesembryanthemum pinnatifidum, L. fil., Cape.
tricolor, Willd., Cape.
— var. album.

Microseris Lindleyi, Gray., N. Amer.

Mimulus cardinalis, Dougl., N. Amer.
cupreus, Veitch., Chili.
Lewisii, Pursh, N. Amer.
luteus, L., N. Amer.
moschatus, Dougl., N. Amer.

Modiola multifida, Mœnch, N. Amer.
(M. caroliniana, Hort.)

Molinia cærulea, Mœnch, Eur.
— var. variegata.

Molospermum cicutarium, DC., C. et S., Eur.

Momordica Elaterium, L., S. Eur.

Moricandia arvensis, DC., Eur., etc.

Morina longifolia, Wall., Nepal.

Muhlenbergia diffusa, Schreb., N. Amer.
pendula, Trin., Ins. Sitcha.
Willdenovii, Trin., N. Amer.

Mulgedium (*see* Lactuca).

Muscari argaei, Hort.
armeniacum, Baker, Medit.
atlanticum, Boiss., Spain, Algeria.
Heldreichii, Boiss., Greece.
Holtzmanni, B. et H.
Maweana, Baker., Orient.
neglectum, Guss., S. Eur.
paradoxa, K. Koch.

Muscari—*cont.*
racemosum, Mill., Eur.
Szovitsianum, Regel, Siber.

Myosotis arvensis, Hoffm., Eur.
palustris, With., Eur.
sylvatica, Hoffm., Eur.
— var. compacta-aurea, Hort.

Myosurus minimus, L., Eur., etc.,

Myrrhis odorata, Scop., Eur.

Nardurus tenellus, Rchb., Spain.

Nardus stricta, L., Eur.

Nasturtium pyrenaicum, R.Br., S. Eur.

Nemesia floribunda, Lehm., Cape.
pubescens, Benth., Cape.
versicolor, Meyer, Cape.

Nemophila aurita, Lindl., Calif.
insignis, Dougl., Calif.
— var. alba, Hort.
— var. grandiflora, Hort.
maculata, Bth., Calif.
parviflora, Dougl., N. Amer.

Nepeta macrantha, Fisch., Siber.
Mussini, Bbrst., Caucas.
Nepetella, L., S. Eur.
nuda, L., S. Eur.

Nicandra physaloides, Gaertn., Peru.

Nicotiana acuminata, Graham, Peru.
affinis, T. Moore.
alata, Link., Brazil.
auriculata, Agardt.
Engelmanni, Hort.
paniculata, L., S. Amer.
plumbaginifolia, Viv., N. Amer.
rustica, L., S. Eur., etc.
— var. Lebanon.
— var. Syrian.
— var. (Texana Hort.)
— var. "Bhilsa."
Tabacum, L., S. Amer.
— var. attenuata, Hort.
— var. "Granville County yellow."
— var. "Havana."
— var. "Hester."
— var. "Hyco."
— var. "Latakia."
— var. "Manila."
— var. "Maryland."

Nicotiana—*cont.*
  Tabacum, var. "Tuckahoe."
  — var. "Virginian."
  — var. "Yellow Pryor."

Nigella damascena, L., S. Eur.
  — var.
  sativa, L., S. Eur.

Nothoscordum fragrans, Kunth., Amer.

Œnanthe crocata, L., Eur.
  globulosa, L., S. Eur.
  gymnorrhiza, Brign., C. et S., Eur.
  karsthia, Hacq., Carniol.
  peucedanifolia, Poll., Eur.

Œnothera amœna, Lehm., Calif.
  (Godetia amœna, Lilja.)
  — var. rubicunda, Hort.
  densiflora, Lindl., Calif.
  fruticosa, L., N. Amer.
  — var. Youngii. Hort.
  glauca, Michx., N. Amer.
  odorata, Jacq., Patagonia.
  pumila, L., N. Amer.
  purpurea, Curt., N. Amer.
  (Godetia purpurea, Wats.)
  rosea, Ait., N. Amer.
  Sarrazinii, (Haage et Schmidt).
  tenella, Cav., Chili, Amer.
  (G. tenella, Wats.)

Ononis arvensis, Mur., Eur.
  Natrix, L., S. Eur.
  spinosa, L., Eur., etc.
  — var. alba.
  repens, L., Eur.
  (procurrens, Wallr.)

Onopordon Acanthium, L., Eur.

Onosma megalosperma = Megacaryon.

Orchis foliosa, Sol., Madeira.
  latifolia, L., Eur.
  maculata, L., Eur.
  — var. superba.

Origanum vulgare, L., Eur.
  — var. album.

Ormenis (*see* Anthemis).

Ornithogalum arcuatum, Steven., Cauc.
  fimbriatum, Willd., Orient.
  orthophyllum, Ten., S. Eur.

Orobanche minor, Sm., Eur.

Orobus (*see* Lathyrus).

Oxyria digyna, Hill., Eur.

Oxytropis ochroleuca, Bunge, Siber.

Pæonia albiflora, Pall., China.
  — var. candida, Anders.
  — var. odorata, Hort.
  — var. rubra, Hort.
  — var. uniflora, Anders., Siberia.
  arietina, Anders., Orient.
  — var. Andersoni.
  — var. byzantina, Hort.
  decora, Anders., Orient.
  — var. Pallasii, Hort.
  officinalis, Retz., Eur.
  — var. anemonæflora, Hort.
  peregrina, Mill., Orient.
  tenuifolia, L., Siber.

Pallenis spinosa, Cass., Eur.

Palava flexuosa, Mast., Peru.

Pancratium illyricum, L., S. Eur.

Panicum Crus-galli, L., S. Eur.
  maximum, Jacq., S. Amer.
  — var. bulbosum.

Papaver Argemone, L., Eur.
  caucasicum, Bbrst., Caucas.
  dubium, L., Eur.
  — var. Lecoqii (Lamotte), Eur.
  lævigatum, Bbrst., Tauria.
  nudicaule, L., Alps.
  — var. album.
  orientale, L., Orient.
  — var. bracteatum, (Lindl.)
  — var. majus.
  pavoninum, C. A. Mey., Afghan.
  pilosum, Sibth., Greece.
  — var.
  Rhœas, L., Eur.
  — var. Hookeri, (Baker).
  — var. "Shirley."
  rupifragum, Boiss., Spain.
  — var. atlanticum, Ball, G. Atlas.
  somniferum, L., China, etc.
  — var. album.
  — var. "Danebrog."
  — var. fl. pl.

Papaver—*cont.*
somniferum, var. setigerum, (DC.)
umbrosum, Hort.

Parietaria lusitanica, L., Eur.
officinalis, L., Eur.

Parnassia nubicola, Hook. fil., Himalaya.

Pastinaca (*see* Peucedanum).

Pentstemon barbatus, Nutt., N. Amer.
— var. Torreyi, Gray.
confertus, Dougl., N. Amer.
diffusus, Dougl., N. Amer.
glaber, Pursh., N. Amer.
Hartwegii, Benth., Mexico.
lævigatus, Soland., N. Amer.
— var. Digitalis, Gray. (P. Digitalis, Nutt.)
ovatus, Dougl., N. Amer.
pubescens, Soland., N. Amer.

Perezia multiflora, Less., Peru, etc.

Petroselinum sativum, Hoffm., Eur.
— var. cordatum.

Petunia nyctaginiflora, Juss., La Plata.

Peucedanum sativum, Benth., Eur. (Pastinaca sativa, L.)

Phaca oroboides, DC., Eur.

Phacelia divaricata, Gray., Calif.
tanacetifolia, Bth., Calif.
viscida, Torr., Calif.
Whitlavia, Gray, Calif. (Whitlavia grandiflora, Hort.)
— var. alba, Hort.

Phalaris arundinacea, L., Eur., etc. (Digraphis arundinacea, Trin.)
— var. fol. variegatis.
canariensis, L., S. Eur., etc.
cærulescens, Desf., S. Eur., etc.
paradoxa, L., S. Eur.
tuberosa, L., Eur.

Phascolus compressus, DC.
— var. cervinus.
ellipticus, Schur.
— var. aureus.
— var. niger.
— var. mesomelus.
lathyroides, L., Jamaica.

Phascolus—*cont.*
multiflorus, Lam.
— var.
oblongus, Savi.
— var. alba-rubra.
— var. Londonensis.
— var. carneo-flavescens.
Ricciardianus, Ten.
tuberosus, Lour., Cochinchina.
vulgaris, L., India.
— var. alba.
Willmotianus, Mart.
Wightianus, Grah., India.

Phleum asperum, Jacq., Eur.
Bœhmeri, Wib., Eur.
pratense, L., Eur.
— var. parnassicum, Boiss.

Phlomis agraria, Ledeb., Siberia.
Russeliana, Lagas., Orient.
tuberosa, L., Caucas., Siber.
umbrosa, Turcz., Siberia.

Phlox paniculata, L., N. Amer.
— var. acuminata.
— var. decussata.

Physalis Alkekengii, L., Eur.

Physostegia virginiana, Bth., N. Amer.
— var. alba, Hort.

Phyteuma campanuloides, Bbrst., Cauc.
Halleri, All., S. Eur.
limonifolium, Sibth. et Sm., Eur.
nigrum, Schmidt, Germ.
orbiculare, L., Eur.
spicatum, L., Eur.

Phytolacca acinosa, Roxb., India.

Pimpinella magna, L., Eur.

Pisum Jombardi, Schrank.
sativum, L., Eur.
— var. Ahebaicum.
— var. quadratum, Mill.

Plantago arenaria, L., Eur.
Coronopus, L., Eur.
— var. Cupani, Guss.
Cumingiana, Fisch. et Mey., Chili.
fuscescens, Jord., S. Eur.
lanceolata, L., Eur.
Oreades, Dcne., New Grenada.

Platycodon grandiflorum, A.DC., Siber.
— var. Mariesii, Hort.

Platystemon californicus, Benth., Calif.

Pleurospermum austriacum, Hoffm., S. Eur.
pulchrum, Aitch. et Hemsl., Afghan.

Poa alpina, L., Eur.
— var. badensis, (Haenke).
caesia, Sm., Eur.
compressa, L., Eur.
glauca, Sm., Eur.
nemoralis, L., Eur.
pratensis, L., Eur.
sudetica, Haenke, Eur.
trivialis, L., Eur.

Podolepis gracilis, Grah., Australia.
— var. alba.

Podophyllum Emodi, Wall., Himal.

Polemonium cæruleum, L., Eur., Amer., etc.
— var. album, Hort.
— var. bipinnatum, Hort.
— var. grandiflorum, Hort.
flavum, Greene, Amer.
himalayanum, Baker., Himal.
humile, Willd., N. Amer. (Richardsonii, Graham.)
pauciflorum, Wats., Mexico.
reptans, L., N. Amer.

Polygonatum biflorum, Ell., N. Amer. (P. pubescens, Pursh.)
giganteum, Dietr., N. Amer. (P. latifolium, Desf.)
japonicum, Morr. et Dcne., Japan.
multiflorum, All., N. T. Zone.
— var. fl. pl.
punctatum, Royle, Himalayas.
verticillatum, All., Eur.

Polygonum amplexicaule, Don, Himal.
— var. oxyphyllum, (Wall.)
aviculare, L., Eur. (P. erectum, Rth.)
Bistorta, L., Eur.
capitatum, Don., Himalayas.
divaricatum, L., Siber.
filiforme, Thunb., Japan.

Polygonum—*cont.*
molle, Don, Himal.
polymorphum, Led., Eur., Siber.
— var. songaricum, (Schrenk.)
viviparum, L., Eur.
Weyrichii, F. Schm., Sachal. Isl.

Polypogon littoralis, Sm., Eur.

Portulaca oleracea, L., China, etc.
— var. grandiflora, vars.
rostellata, Brign., Brazil.

Potentilla alchemilloides, Lap., Pyrenees.
argentea × verna.
argyrophylla, Wall., Himal.
— var.
— var. Thomasii, (DC.)
Comarum, Nestl., Eur.
digitata × flabellata.
Fenzelii, Lehm., Cappadocia.
glandulosa, Ldl., Calif.
Kotschyana, Fenzl., Kurdistan.
Kurdica, Boiss., Orient.
laciniosa, W. et K., Hungary.
nepalensis, Hook., Nepal. (P. formosa, Don.)
nevadensis, Boiss., Spain.
norvegica, L., Eur.
opaca, L., Eur., etc.
pedata, Willd., France.
pennsylvanica, L., N. Amer.
— var. arachnoidea, Lehm. (P. arachnoidea, Dougl.)
recta, L., Eur., Caucas.
— var. Hookeriana, (Lehm.)
— var. laciniata.
— var. macrantha, (Leab.)
— var. Nuttallii.
— var. obscura (Willd.)
— var. palmata.
— var. pentaphylla, (Rich.)
rupestris, L., Eur.
Sibbaldia, Haller fil., Himal. (Sibbaldia procumbens, L.)
Visianii, Panc., Eur.
Wrangeliana, Fisch., Siberia.

Poterium alpinum, Bunge, Siberia.
officinale, Benth. et Hook., Eur. (Sanguisorba officinalis, L.)
— var. carneum, Hort.
Sanguisorba, L., Eur.

Primula Auricula, L., Eur.
elatior, Jacq., Eur.
japonica, Gray, Japan.
mollis, Nutt., Bootan.
obconica, Hance., China.
prolifera, Wall., Himal.
sikkimensis, Hook., Himal.
verticillata, Forsk., Arabia.

Prunella grandiflora, L., Eur., Cauc.
var. laciniata, Hort.
— var. rubra, Hort.
vulgaris, L., Eur.

Pteroneuron = Cardamine.

Pyrethrum (*see* Chrysanthemum).

Pyrrhopappus carolinianus, DC., Florida, Texas.

Ramondia pyrenaica, Rich., Pyrenees.

Ranunculus abortivus, L., N. Amer.
aconitifolius, L., Eur.
acris, L., Eur.
— var. Correanus.
— var. Steveni, Bess.
arvensis, L., Eur.
brutius, Tenore, Italy.
cassius, Boiss., Taurus.
chærophyllus, L., Eur., etc.
Chius, DC., Greece, etc.
Cymbalaria, Pursh, N. Amer.
falcatus. L., Eur.
Lingua, L., Eur.
maritimus, Ph., Chili.
muricatus, L., Eur
parviflorus, L., Eur.
Reuterianus, Boiss., S. Eur.
trachycarpus, F. et M., Orient.

Raphanus sativus, L., Eur.

Rapistrum Linnæanum, All., Eur.

Reseda abyssinica, Fres., Abyss.
alba, L., S. Eur.
glauca, L., Spain.
Luteola, L., Eur.

Rhagadiolus creticus, All., S. Eur. (Hedypnois cretica, Willd.)
stellatus, Gærtn., S. Eur.

Rheum Emodi, Wall., Himal.
leucorrhizum, Pall., Siber.
macropterum, Mart.
palmatum, L., Ind., etc.
— var. tanghuticum.

Rheum—*cont.*
Rhaponticum, L., Siber.
spiciforme, Royle, India.
undulatum, L., Siberia, etc.
Webbianum, Royle., India.

Rhodanthe (*see* Helipterum).

Rudbeckia californica, Gray, Calif.
fulgida, Ait., N. Amer.
laciniata, L., N. Amer.
occidentalis, Nutt., N. Amer.
— var.
pinnata, Vent., N. Amer.
speciosa, Wend., N. Amer.

Rumex abyssinicus, Jacq., Abyss.
alpinus, L., Eur.
Brownianus, Campd., Austral.
maximus, Schreb., Eur.
nepalensis, Spr., Himal.
obtusifolius, L., Eur.
— var. sylvestris, (Wallr.)
Patientia, L., S. Eur.
salicifolius, Weinm., N. Amer.
sanguineus, L., Eur.
— var. viridis (Sibth.)
vesicarius, L., N. Afr.

Ruta graveolens, L., Eur.
— var. variegata.

Sagina glabra, Willd., S. Eur.
— var. pilifera.
Linnæi, Presl., Eur.

Salvia argentea, L., Medit.
coccinea, L., Mexico.
glutinosa, L., Eur.
Horminum, L., S. Eur.
— var. bracteis violaceis.
hians, Royle., Ind.
interrupta, Schousb., Marocco.
nubia, Ait., Abyssinia.
pratensis, L., Eur.
— var. rosea.
officinalis, L., S. Eur.
— var. alba, Hort.
Regeliana, Trautv., Siberia.
Sclarea, L., S. Eur.
sylvestris, L., S. Eur.
— var. alba, Hort.
tiliæfolia, Vahl, Mexico.
Verbenaca, L., Eur.
verticillata, L., Eur.

Sanicula marylandica, L., N. Amer.

Sanguisorba (*see* Poterium).

Saponaria orientalis, L., Orient.

Satureja hortensis, L., Taur., Caucas.
montana, L., S. Eur.

Saxifraga altissima, Kerner, Eur.
aphylla, Sternb., Eur.
— var. leptophylla.
— var. virescens.
Aizoon, L., Eur., Alps.
— var. Churchillii, Kern.
— var. Gaudinii.
— var. incrustata.
— var. infracta.
— var. minor.
— var. pectinata, Schott.
— var. pygmæa.
— var. recta, (Lap.)
— var. rotata.
— var. rosularis, Schleich.
cæspitosa, L., Eur., etc.
— var. decipiens, (Ehrh.)
— var. hirta, (Don.)
— var. sedoides, (L.)
Cotyledon, L., Eur., Alps.
— var. pyramidalis, (Lap.)
crustata, Vent., Alps.
diversifolia, Wall., Himal.
exarata, Vill., Eur., Alps.
— var. nervosa, (Lap.)
Hostii, Tausch, Alps.
— var. Macnabiana, Hort.
— var. tristis.
Kolenatiana, Regel, Siberia.
lactea, Turcz., Temp. Asia.
lasiophylla, Schott., Europe.
lingulata, Bell., Marit. Alps.
— var. cochlearis, (Rchb.)
— var. lantoscana, (Boiss.)
longifolia, Lap., Pyrenees.
muscoides, Wulf., Eur.
— var. purpurea.
— var. pygmæa, (Haw.)
pedemontana, All., S. Eur.
peltata, Torr., N. Amer.
pennsylvanica, L., N. Amer.
Prostii, Sternb., Eur.
Rocheliana, Sternb., Bosnia.
— var. coriophylla, (Griseb.)
rotundifolia, L., Eur.
— var. hirsuta.
sponhemica, Gmel., S. Eur.
tenella, Wulf., Alps.
trifurcata, Schrad., N. Spain.
valdensis, DC., Savoy, Alps.

Scabiosa, atropurpurea, L., Eur.
caucasica, Bbrst., Cauc.
— var. amœna, (Jacq.)
Columbaria, L., Eur.
graminifolia, L., Eur.
Gramuntia, L., S. Eur.
Hladnikiana, Host., Carniol.
palæstina, L., Syria, etc. (Asterocephalus palæstinus, Spr.)
Portae, Huter., Eur.
Succisa, L., Eur.

Scandix Balansæ, Reut., Orient.
brachycarpa, Guss., Sicily.

Schizanthus pinnatus, R. et P., Chili.
var. albus, Hort.

Schizopetalum Walkeri, Sims, Chili.

Scilla campanulata, Ait., Spain, etc.
(S. hispanica, Mill.)
— var. alba, Hort.
— var. rubra.
italica, L., Italy, etc.
verna, Huds., W. Eur.

Scirpus atrovirens, Muhl., N. Amer.
Caricis, Retz., Eur. (Blysmus compressus, Panz.)
setaceus, L., Eur.
sylvaticus, L., Eur.

Schismus marginatus, Beauv., S. Eur.

Scleranthus annuus, L., Eur.
perennis, L., Eur.

Scrophularia Ehrhartii, Stev., Caucas.
nodosa, L., Eur.
— var. serrulata.
Scorodonia, L., Eur.

Scutellaria alpina, L., Eur.
— var. versicolor.
altissima, L., Caucas.
peregrina, L., Tauria.

Secale montanum, Guss., Sicily.

Sedum Aizoon, L., Siberia.
crassipes, Wall., Sikkim, 15,000 feet.

Sedum—*cont.*
cyaneum, Rud., Siber.
Ewersii, Ledeb., Siber.
heterodontum, Hk. f., Himal.
hybridum, L., Siberia.
kamtschaticum, Fisch., Kamtsch.
Maximowiczii, Regel, Japan.
populifolium, L., Siberia.
rhodanthum, A. Gr. Rocky Mts.
Rhodiola, DC., Siber.
(Rhodiola sibirica, Sweet.)

Sempervivum alpinum, G. et S.,
arvernense, Lecoq et Lamotte, Eur.
bicolor, Hort., Eur.
Boissieri, Hort., Eur.
fimbriatum, L. et S., Eur.
Funckii, Braun, Austria.
grandiflorum, Haw.
Hausmannii, Hort., Eur.
Mettenianum, Lehm., Switz.
montanum, L., Alps.
Neideri, Hort.
parvulum, J. et F., Eur.
Pomelii, Lamotte, Alps.
Schnittspahnii, Lag., Eur.
speciosum, Lamotte, Eur.
tectorum, L., Eur.
Verlotii, Lamotte, France.
(S. Delassiæ, Hort.)

Senecio artemisiæfolius, Pers., S. Eur.
Clusii, Schultz., Eur.
concolor, DC., N. Afr.
elegans, L., Cape.
— var. alba.
— var. purpurea
Fuchsii, Gmel., S. Eur.
Jacquinianus, Rchb., Eur.
Kaempferi, DC., Japan.
macrophyllus, Bbrst., Caucas.
quinquiculatus, Rgl., Asia Minor.
sarracenicus, L., Eur., etc.
squalidus, L., Eur., etc.
thyrsoideus, DC., Siberia.
(Ligularia thyrsoidea, DC.)
viscosus, L., Eur.

Serratula coronata, L., Siberia.
— var. macrophylla.
Gmelinii, Ledeb., Caucas.

Serratula—*cont.*
quinquefolia, Bbrst., Caucas.
tinctoria, L., Eur.
— var. indivisa, Poir.

Seseli gracile, W. K., Transylvania.
gummiferum, Sm., Greece.
Hippomarathrum, L., S. Eur.
tortuosum, L., S. Eur.

Setaria glauca, Beauv., Eur.
italica, Beauv., Eur.
(S. germanica, Beauv.)
macrochæta, Link, Eur., Asia, etc.
viridis, Beauv.

Sherardia arvensis, L., Eur.

Sibbaldia (*see* Potentilla).

Sicyos Baderoa, Hk. et Arn., Chili.

Sidalcea malvæflora, Gr., Amer.
(S. oregana, Gr.)

Sideritis scordioides, L., Eur.
— var. elongata, Benth., Spain?

Silene Armeria, L., Eur.
— var. compacta, (Hornem.)
Chouleti, Coss., Eur.
ciliata, Pourr., Crete.
clandestina, Jacq., Cape.
colorata, Poir., Mediter.
conoidea, L., Levant, etc.
Cucubalus, Wibel., Eur.
diurniflora, Kunze, Cape.
echinata, Otth., Italy.
Fortunei, Vis., China.
fusca, Link, Portugal.
gallica, L., Eur.
— var.
glauca, Zea., Eur.
italica, Pers., Eur.
juvenalis, Del., Egypt.
linicola, Gmel., Germany.
longicilia, Otth, Portugal.
muscipula, L., Mediter.
nocturna, L., S. Eur.
nutans, L., Eur.
obtusifolia, Willd., Italy.
paradoxa, L., S. Eur.
pendula, L., Sicily, etc.
Persoonii, Tod. non Schott.
pseudo-atocion, Desf., N. Afr.
quadrifida, L., Eur.
rubella, L., Eur., N. Afr.

Silene—*cont.*
Sartori, Boiss., Greece.
Schafta, Gmel., Siber., etc.
sedoides, Jacq., Crete.
sericea, All., S. Eur.
tatarica, Pers., Tatar.
tenuifolia, Otth., Dahur.
trinervia, S. et S., S. Eur.
vesiculifera, Gay, S. Eur.
vespertina, Retz., S. Eur.
Zawadskii, Herbich., Austria.

Silphium aurantiacum, Hort.
integrifolium, Michx., N. Amer.
perfoliatum, L., N. Amer.
(S. connatum, L.)
— var. conjunctum, (Willd.)
scaberrimum, Ell., N. Amer.

Silybum eburneum, Coss. et Dur., Eur.
Marianum, Gærtner, Eur.

Sisymbrium Alliaria, Scop., Eur.
austriacum, Jacq., S. Eur.
erysimoides, Desf., S. Eur., N. Afr.
myriophyllum, H. B. K., Quito.
officinale, Scop., S. Eur.
polyceratium, L., Eur.
strictissimum, L., Eur.

Sisyrinchium anceps, Cav., N. Amer.
reticulatum, Hort.
striatum, Sm., Chili.

Smilacina stellata, Desf., N. Amer.
racemosa, Desf., N. Amer.
(Tovaria racemosa, Neck.)

Smyrnium Olusatrum, L., Eur.

Solanum Dulcamara, L., Eur.
guineense, Lam., Trop. Afr., etc.
laciniatum, Ait. Austral.
sisymbriifolium, L., S. Amer.
tuberosum, L., Chili.
— var. black tubers.
villosum, Lam., Eur.

Solidago arguta, Ait., N. Amer.
cæsia, L., N. Amer.
canadensis, L., N. Amer.
elongata, Nutt., N. Amer.
neglecta, T. et G., N. Amer.

Solidago—*cont.*
Ohiœnsis, Riddell, N. Amer.
Shortii, T. et G., N. Amer.

Sonchus asper, Hoffm., Eur.
oleraceus, L., Eur.
palustris, L., Eur.

Specularia falcata, A.DC., Mediter.
— var. castellana, Lange.
pentagonia, A.DC., Orient.
perfoliata, DC., N. Amer.
Speculum, A.DC., Eur.

Spergula arvensis, L., Eur.

Sphenogyne (*see* Ursinia).

Spiræa astilboides, Hort.
Aruncus, L., N. Amer.
— var. angustifolius.
digitata, Willd., Siber., etc.
lobata, Jacq., N. Amer.
palmata, Thunb., Japan.

Stachys arvensis, L., Eur.
grandiflora, Bth., Caucas., etc.
(Betonica grandiflora, L.)
Betonica, Benth., Eur. (B. officinalis, L.)
— var. alba, Hort.
elliptica, H.B.K., S. Amer.
sylvatica, L., Eur.

Statice Gougetiana, Girard, Spain.
Limonium, L., Eur.
— var. alba, Hort.
— var. Gmelini, (Willd.)
— var. puberula.
— var. Smithii, Hort.
lychnidifolia, Gir., S. Eur.
speciosa, L., Siberia.
tomentella, Boiss., Eur., etc.
(S. sareptana, Beck.)

Stipa barbata, Desf., N. Afr.
gigantea, Lag., Spain.

Swertia perennis, L., Eur. Cauc.

Symphyandra Wanneri, Heuff.

Syrenia Lamarckiana, Andrz., Russia, Siberia.

Symphytum asperrimum, Sims, Caucas.
officinale, L., Eur.

Tagetes lucida, Cav., Mexico.
Parryi, Gray., Mexico.
patula, L., Mexico.
pusilla, H B., Quito.

Tamus communis, L., Eur.

Taraxacum corniculatum, DC., Eur.

Tellima grandiflora, R.Br., N. Amer.

Teucrium Chamædrys, L., Eur.
— var. folio-aurea.
Scorodonia, L., Eur.
— var. variegatum.

Thalictrum angustifolium, Jacq., S. Eur.
— var. (T. nigricans, DC.), Eur.
aquilegifolium, L., Eur., etc.
— var. purpureum.
flavum, L., Eur.
— var.
— var. sphærocarpum, Lej.
glaucum, Desf., S. Eur.
javanicum, Blume, Java.
minus, L., Eur.
— Indian form.
— var. affine, (Jord.).
— var. collinum, (Wallr.)
— var. elatum, Regel.
— var. kemense, (Fries.)
— var. squarrosum, (Steph.)
trigynum, Fisch., Dahur.

Thermopsis montana, Nutt., N. Amer.
(fabacea, DC.)

Thlaspi arvense, L., Eur.
alpestre, L., Eur.
præcox, Wulf., Austria.

Thrincia hirta, DC., Eur.
tuberosa, DC., S. Eur.

Tigridia Pavonia, Pers., Mexico.
Pringlei, Wats., Mexico.
speciosa, Poit.

Tolmiea Menziesii, Torr. et Gray, N. Amer.

Tolpis virgata, Bert., S. Eur.

Tovaria (*see* Smilacina).

Trachelium cœruleum, L., N. Afr., etc.

Trachymene pilosa, Sm., Austral.

Tradescantia erecta, Jacq., Mexico.
virginica, L., N. Amer.

Tragopogon (Geropogon glabrum, L.), S. Eur.

Trifolium agrarium, L., Eur.
badium, Schreb., Eur.
hybridum, L., Eur.
Lagrangei, Boiss., Orient.
leucanthum, Bbrst., Tauria, etc.
multistriatum, Koch, Eur.
pannonicum, L., Eur., etc.
Perreymondi, Gren., France.
rubens, L., Eur.
stellatum, L., S. Eur.
squarrosa, L., S. Eur.
(Panormitanam, Pr.)

Triglochin maritimum, L., Eur.

Trigonella corniculata, L., S. Eur.
cretica, Boiss., Crete.
fœnum-græcum, L., S. Eur.
hamosa, L., Orient.
ovalis, Boiss., Spain.
polycerata, L., Eur.
(T. orthoceras, Kar. et Kir., Altai.)

Trinia Kitaibelii, Bbrst., Russia, etc.

Tripteris cheiranthifolia, Schultz., Abyss.

Triticum durum, Desf., S. Eur., N. Afr.
monococcum, L., Eur.
villosum, Beauv., S. Eur.
vulgare, Vill., Asia.

Tritonia crocosmaeflora, Garden Hybrid.
Pottsii, Benth., Cape.

Trollius asiaticus, L., Siber.
europæus, L., Eur.
— var. Denayanus, Hort.

Tropæolum aduncum, Sm., Peru, etc. (T. peregrinum, Jacq. T. canariense, Hort.)
majus, L., Peru.
minus, L., Peru.

Tulipa australis, Link, S. Eur.

Tunica Saxifraga, Scop., Eur.

Tyrimnus leucographus, Cass., S. Eur.

Urospermum Dalechampii, Desf., S. Eur.
picroides, Desf., S. Eur.

Ursinia pulchra, N. E. Brown, Cape. (Sphenogyne speciosa, Know. et West.)
— var. sulphurea, Hort., Kew.
anthemoides, Poir., Cape. (Sphenogyne anthemoides, R. Br.)

Urtica dioica, L., Eur.
elevata Banks, Madeira.
— var. grandidentata.
pilulifera, L., Eur.

Valeriana alliariæfolia, Vahl, Caucas.
— var. intermedia.
montana, L., Eur.
officinalis, L., Eur.
— var. exaltata, (Mikan.)
— var. sambucifolia, (Mikan.)
Phu, L., S. Eur.
— var. aureo-variegata.
pyrenaica, L., Eur.

Valerianella Auricula, DC., Eur.
carinata, Loisl., S. Eur.
clorodonta, Coss. et Dur., Algeria.
cymbaecarpa, C. A. Mey., Caucas.
eriocarpa, Desv., Eur.
hamata, DC., S. Eur.
Morisonii, DC., Eur. Taur.
olitoria, Mœnch., Eur.
Szovitsiana, F. et M., Persia.

Veratrum album, L., Eur.
nigrum, L., Eur.

Verbascum gnaphalodes, Bbrst., Taur., etc.
olympicum, Boiss., Bithynia.
phœniceum, L., Eur. Siber.
— var. ferrugineum, (Mill.)
Thapsus, L., Eur.
— var. turkestanicum, Regel.

Verbena hispida, R. P., S. Amer.

Veronica anagallis, L., Eur.
anomala, Armstr., N. Zeal.
austriaca, L., C. et S. Eur.
— var. pinnatifida, Pohl.
arvensis, L., Eur.
azurea, Link., Eur.
Beccabunga, L., Eur.
bellidioides, L., Eur.
corymbosa, Hort., Loud.
gentianoides, Vahl, Taur., etc.

Veronica—*cont.*
incana, L., S. Eur., etc.
incisa, Ait., Siber.
ligustrifolia, Cunn., N. Zeal.
longifolia, L., C. et S. Eur.
— var. alba.
— var. mollis.
— var. rosea.
maritima, L., Eur.
— var. variegata.
saxatilis, L., Eur.
serpyllifolia, L., Eur.
— var. humifusa, (Dicks.)
spicata, L., Eur., etc.
spuria, L., Eur.
— var. Kalnitzii.
Teucrium, L., Eur.
— var. latifolia, (L.)
virginica, L., N. Amer.
— var. japonica, (Steud.)

Vesicaria corymbosa, Hort.
cretica, Poir., Crete.

Vicia amphicarpa, Dorth., France.
bœtica, Fisch., Siberia.
calcarata, Desf., Algiers.
cassubica, L., S. Eur.
disperma, DC., France.
Ervilia, Willd., S. Eur.
Faba, L., cultivated.
— var. equina, (Pers.)
Ludoviciana, Nutt., N. Amer.
narbonensis, L., S. Eur.
onobrychioides, L., Eur.
Orobus, DC., Eur.
pannonica, Jacq., Eur.
sativa, L., Eur., etc.
— var. Morisiana, (Jord.)
sepium, L., Eur.
sitchensis, Bong., N. Amer., etc. (V. gigantea, Hook.)
sylvatica, L., Eur.
unijuga, A. Braun., Siberia. (Orobus lathyroides, L.)
— var. compacta, Hort., Kew.
villosa, Roth., S. Eur.

Viola cornuta, L., Eur.
— var. alba.
cucullata, Ait., N. Amer.
Jooi, Janka, Transylv.
odorata, L., Eur.
palustris, L., Eur.
pumila, Willd., S. Eur.
Reichenbachiana, Bor., Eur.

Wahlenbergia lobelioides, A.DC., Madeira.

Whitlavia (*see* Phacelia).

Wulfenia carinthiaca, Jacq., Carinth.

Xanthium indicum, Wall., Ind., etc. (X. orientale, L.)
strumarium, L., Eur.

Xanthocephalum gymnospermoides, B. et Hk. f., Arizona.

Xeranthemum longipapposum, F. et M., Persia.

Zinnia elegans, Jacq., Mexico.
multiflora, L., Mexico.

Ziziphora capitata, L., Taur., etc.

Zollikoferia Elquinensis, Phil., Chili.

Zygadenus elegans, Pursh, N. Amer. (Z. commutatus, Schult. fil., Z. canadensis, Hort., Z. chloranthus, Richards, Anticlea glauca, Kunth.)
glaberrimus, Michx., N. Amer.
Nuttallii, Gray, N. Amer.

TREES AND SHRUBS.

Abies cephalonica, Lk., Greece.
Pindrow, Spach, Himalaya.

Acer campestre, L.
— var. hebecarpum, Hort.
— var. leiocarpum.
Lobelii, Ten., S. Eur.
macrophyllum, Pursh., N. W. Amer.
neapolitanum, Ten., Eur.
obtusatum, Kit., Eur.
pennsylvanicum, L., N. Amer.
platanoides, L., Eur.
Pseudo-Platanus, L., Eur., etc.
— var. flavo-marginatum, Hort.
— var. fol. variegatum, Hort.
— var. lutescens, Hort.
— var. purpurea, Hort.

Alnus cordifolia, Ten., Italy.
firma, S. et Z., Japan.
glutinosa, Gærtn.
— var. rubronervia, Hort.
— var. sorbifolia, Hort.
incana, Will., N. Hemisphere.
— var. glauca, (Ait.)
— var. laciniata, Hort.
orientalis, Dcne., Orient.
rubra, Bong., N.W. Am.
serrulata, Willd., N. Am.

Amorpha fruticosa, L., N. Amer.

Aralia cachemirica, Dcne., Himalaya.
edulis, S. et Z., Japan.

Aucuba japonica, Thunb.
vera, Hort.

Betula alba, L., N. Hemisph.
— var. Youngii, Hort.
lenta, L., N. Amer.
lutea, Michx. f., N. Amer.
papyracea, Ait., N. Amer.
ulmifolia, S. et Z., Japan.

Berberis aristata, DC., Himal.
buxifolia, Lamk., Chili.
canadensis, Mill., N. Amer.
Darwinii, Hook. f., Chili.

Berberis—*cont.*
sinensis, Desf., China.
stenophylla, Hort.
Thunbergii, DC., Japan.
virescens, Hook. f., Himalaya.
vulgaris, L., Eur., etc.
— var. emarginata, Hort.
— var. iberica, (Stev.)
— var. lucida, (Schrad.)
— var. purpurea, Hort.
— var. sanguinolenta, Hort.
— var. spathulata, (Schrad.)
— var. violacea, Hort.
Wallichiana, DC., Himal.

Buddleia japonica, Hemsl., Japan.

Biota orientalis, End., Orient.

Buxus sempervirens, L., Eur. Asia.
— var. latifolia, Hort.
— var. prostrata, Hort.

Caragana arborescens, Lamb., Siberia.
frutescens, DC., Siberia.
— var. pendula, Hort.
Redowskii, DC., Siberia.

Carpinus Betulus, L., Eur., etc.

Cassinia fulvida, Hook. f., N. Zeal. (Diplopappus chrysophyllus, Hort.)

Cedrus Deodara, Loud., Himal.

Celtis occidentalis, L., N. Amer.

Cerasus lusitanica, Lobel., Portugal.

Cercis Siliquastrum, L., Mediterr. Region.

Chamaecyparis (Cupressus).
Lawsoniana, Parl., Calif.
— var. albo-spica, Hort.
— var argentea, Hort.
— var. californica, Hort.
— var. fragrans argentea, Hort.
— var. gracilis pendula, Hort.
— var. intertexta, Hort.

Chamaecyparis—*cont.*
Lawsoniana, var. ochroleuca, Hort.
obtusa, S. et Z., Japan. (Retinospora obtusa.)

Cistus laurifolius, L., Spain.

Cladrastis amurensis, Benth. et Hook., Amur.

Clematis Fremontii, S. Wats., N. Amer.
Pitcherii, Torr. et Gray, N. Amer.
Viticella, L., Eur.
— var. rubra, Hort.

Colutea arborescens, L., Eur.
— var. cruenta, (Ait.)
— var. haleppica, (Lamk.)

Cornus alba, L., N. Amer.
pubescens, Nutt., N. Amer.
sanguinea, L., Eur.
sericea, L., N. Amer.

Cotoneaster acuminata, Lindl., Himal.
bacillaris, Wall., Himal.
— var. floribunda, Hort.
buxifolia, Wall., Himal.
frigida, Wall., Himal.
horizontalis, Dcne
microphylla, Wall., Himal.
nummularia, F. et M., Asia, etc.
rotundifolia, Wall., Himal.
Simonsii, Baker., Himal.
tomentosa, Lindl., Eur.

Crataegus Carrierei, Vauvel. (C. Lavallei, Herincq.)
coccinea, L., N. Amer.
— var. acerifolia, Hort.
— var. glandulosa, Hort.
— var. indentata, Hort.
— var. macracantha, (Lodd.)
cordata, Mill., N. Amer.
Crus-Galli, L., N. Amer.
— var. prunifolia, (Pers.)
Douglasii, Lindl., N. Amer.
Downingii, Hort.
heterophylla, Flugge.
leucophleos, Mœnch., N. Amer.
nigra, W. et K., E. Eur.
orientalis, Pall., Orient.
oxyacantha, L., Eur.
— var. eriocarpa, Hort.

Crataegus—*cont.*
oxyacantha, var. flexuosa, Hort.
— var. fusca, Hort.
— var. Gumperi bicolor, Hort.
— var. monogyna, (Jacq.)
— var. obtusata, Hort.
— var. pendula, Hort.
— var. pentagyna, Hort.
— var. punicea, Hort.
— var. Reginæ, Hort.
— var. stricta, Hort.
punctata, Jacq., N. Amer.
sanguinea, Pall., var. songorica.
tanacetifolia, Pers., Orient.
tomentosa, L.

Cytisus albus, L., S. W. Eur.
— var. incarnatus, Hort.
capitatus, Jacq., S. Eur.
biflorus, L., Herit., Eur.
hirsutus, L., S. Eur.
leucanthus, W. et K., E. Eur.
× præcox, Hort.
scoparius, L., Eur.
— var. pendula, Hort.
uralensis.

Dabœcia polifolia, D. Don., W. Eur.
— var. versicolor.

Deutzia crenata, S. et Z., Japan.
— var. Sieboldii, Hort.
scabra, Thunb., Japan.

Elaeagnus argentea, Pursh., N. W. Amer.
japonicus, Hort.
longipes, A. Gray., Japan.
umbellata, Thunb., Japan.

Euonymus europaeus, L., Eur.
— var. coccineus, Hort.
latifolius.

Forsythia suspensa, Vahl., Japan, etc.

Fraxinus Ornus, L., Eur.
— var. latifolia, Hort.

Gaultheria Shallon, Pursh., N. Amer.

Genista ætnensis, DC., Sicily.
radiata, Scop., S. Eur.
sagittalis, L., Eur.
virgata, DC., Madeira.

Hamamelis virginica, L., N. Amer.

Hedera Helix, L., Eur., etc.
— var. arborea fol. aur., Hort.

Hippophæ rhamnoides, L., Eur., etc.

Hypericum Androsaemum, L., Eur.
elatum, Ait., N. Amer.

Ilex Aquifolium, L., Eur.
— var. ciliata, Hort.
— var. platyphylla, Hort.

Kalmia glauca, Ait., N. Amer.
latifolia, L., N. Amer.

Laburnum Adami, Lav.
(Laburnum × Cytisus purpureus.)
vulgare, Griseb., Eur.
— var. aureum, Hort.
— var. Carlieri, Hort.
— var. involutum, Hort.
— var. Parkesi, Hort.

Ledum palustre, L., Eur., etc.
latifolium, Ait., N. Amer.

Ligustrum vulgare, L., Eur. etc.

Lonicera discolor. Lindl., Himal.
Morrowii, Gray., Japan.
tatarica, L.
— var. kamtschatica, Hort.
Xylosteum, L., Eur.

Mahonia Aquifolium, Nutt.
— var. Murrayana, Hort.
fascicularis, DC., N. Amer.
japonica, DC., Japan.

Menispermum canadense, L., N. Amer.

Morus nigra, L., Eur.

Neillia amurensis (Spiræa, Maxim.), Amurland.
opulifolia, Benth. et Hook., N. Amer.
— var. lutea, Hort.
— var. nana, Hort.

Olearia Haastii, Hook. fil., N. Zeal.

Pernettya mucronata, Gaud., Chili, etc.

Potentilla fruticosa, L., Eur.
— var. floribunda, Hort.

Ptelea trifoliata, L., N. Amer.
— var. aurea, Hort.
— var. glauca, Hort.

Pyrus americana, DC., N. Amer.
Aria, Ehrh.
— var. græca, Boiss.
arbutifolia, L., N. Amer.
— var. erythrocarpa, Gr.
— var. grandiflora, Hort.
— var. serotina, Lindl.
Aucuparia, Gaertn., Eur.
— var. pendula, Hort.
latifolia, Syme.
Maulei, Masters, Japan.
— var. superba, Hort.
spectabilis, Desf., China, etc.

Rhamnus alnifolius, L., N. Amer.
infectorius, L., S. Eur.
latifolius, L'Herit. Azores.
Wicklius, Hort.

Rhodotypus kerrioides, S. et Z., Japan.

Rhus Cotinus, L., Eur.
radicans, L., N. Amer.
typhina, L., N. Amer.

Ribes alpinum, L., Eur.
— var. laciniatum, Hort.
— var. opulifolium, Hort.
— var. pumilum, Hort.
aureum, Pursh., N. Amer.
— var. praecox, Hort.
nigrum, L., N. Eur.
sanguineum, Pursh., N.W. Amer.
— var. atrorubens, Hort.
— var. atrosanguineum, Hort.
— var. glutinosum, Benth.

Rosa Alberti, Rgl., E. Asia.
alpina, L., Eur.
— var. inermis.
Bakeri, Desegl., England.
belgradensis, Hort.
californica, Ch. et Sch., Calif.
canina, L., Eur., etc.
— var. andegavensis, Baker.
carolina, L., N. Amer.
cinnamomea, L., Eur., etc.
gallica, L., Eur., var.
hibernica, Sm., Britain.
— var. vera.
lucida, Ehrh., N. Amer.
microcarpa, Hort.

- Rosa—*cont.*
  - microphylla, Roxb., China.
  - mollis, Sm., Eur.
  - moschata, Mill., India, etc. (R. Brunoni, Lindl.)
  - nutkana, Presl., N. Amer.
  - omissa, Déségl., Eur.
  - pisocarpa, A. Gray, N. Amer.
  - polyantha, S. et Z., Japan.
  - rubiginosa, L., Europe, etc.
  - — var. major, Hort.
  - rubrifolia, Vill., Eur.
  - rugosa, S. et Z., Japan.
  - — var. alba.
  - sericea, Lindl., Himal.
  - spinosissima, L., Eur.
  - — var. cistiflora, Hort.
  - — var. picta, Hort.
  - — var. pusilla, Hort.
  - — var. rubra, Hort.
  - tomentosa, Sm., Eur., etc.
  - — var. dimorpha.
  - — var.
  - Wilsoni, Bor., Britain.
- Rubus Balfourianus, Blox., Eur.
  - cordifolius, W. et N., Eur.
  - laciniatus, Willd., Hort.
  - leucostachys, Sm., Eur.
  - Lindleyanus, Lees, Eur.
  - mucronatus, Blox., Eur.
  - occidentalis, L. et N., Amer.
  - rhamnifolius, W. et N., Eur.
  - rudis, W. et N., Eur.
  - strigosus, Michx., N. Amer.
  - thyrsoideus, Wimm., Eur.
  - villicaulis, Koehl., Eur.
- Sambucus canadensis, L., N. Amer.
  - nigra, L., Eur.
  - — var. aurea, Hort.
  - — var. laciniata, Hort.
  - — var. melanocarpa, Hort.
  - — var. rotundifolia, Hort.
- Sambucus—*cont.*
  - — var. swindonensis, Hort.
  - — var. virescens, Hort.
- Santolina viridis, L., W. Eur.
- Skimmia Fortunei, Mast. (S. japonica, Hort.)
- Spartium junceum, L., S. Eur.
- Spiraea canescens, Don., Himal.
  - carpinifolia, Pall., Eur.
  - Douglasii, Hook., N.W. Amer.
  - hypericifolia, L., Eur.
  - japonica, L. fil., Japan.
  - — var. ruberrima, Hort.
  - Lindleyana, Wall., Himal.
  - paniculata, L.
  - salicifolia, L., N. Amer.
  - splendens, Hort.
- Staphylea pinnata, L., Eur.
- Symphoricarpus racemosus, Michx., N. Amer.
- Syringa Emodi, Wall., Himal.
- Taxus baccata, L., Eur., etc.
  - — var. Dovastonii, Hort.
  - — var. fructu-luteo, Hort.
  - — var. Washingtoni, Hort.
- Thuja Dicksoni, Hort.
  - gigantea, Nutt., N.W. Amer.
  - occidentalis, L., N. Amer.
  - plicata, Don., N. Amer.
  - Standishii, Carr., Japan.
- Ulex europaeus, L., Eur.
  - Welwitschianus, Planch., S.W. Eur.
- Vaccinium maderense, Link., Azores.
- Viburnum Opulus, L., Eur., etc.
  - — var. edule, Hort.
  - — var. fructu-luteo, Hort.
  - — var. roseum, Hort.

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX II.—1891.

NEW GARDEN PLANTS.

The number of garden plants annually described in botanical and horticultural publications, both English and foreign, is now so considerable that it has been thought advisable to publish a complete list of them in the *Kew Bulletin* each year (*see* April numbers for 1888 and 1889 and Appendix II. 1890). The following list comprises all the new introductions recorded during 1890. These lists are indispensable to the maintenance of a correct nomenclature, especially in the smaller botanical establishments in correspondence with Kew, which are, as a rule, only scantily provided with horticultural periodicals. Such a list will also afford information respecting new plants under cultivation at this establishment, many of which will be distributed from it in the regular course of exchange with other botanic gardens.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
88 and 90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Twopence.

The present list includes not only plants brought into cultivation for the first time during 1890, but the most noteworthy of those which have been re-introduced after being lost from cultivation. Other plants included in the list have been in gardens for several years, but either were not described or their names had not been authenticated until recently.

In addition to species and botanical varieties, all hybrids, whether introduced or of garden origin, but described for the first time in 1890, are included. Mere garden varieties of such plants as Coleus, Codiæum, or Narcissus are omitted for obvious reasons.

In every case the plant is cited under its published name, although some of the names are doubtfully correct. Where, however, a correction has appeared desirable this is added.

The name of the person in whose collection the plant was first noticed or described is given where known.

An asterisk is prefixed to all those plants of which examples are in cultivation at Kew.

The publications from which this list is compiled, with the abbreviations used to indicate them, are as follows:—*B. M.*—Botanical Magazine. *B. T. O.*—Bullettino della R. Società Toscana di Orticultura. *Bull Cat.*—Bull, Catalogue of New, Beautiful, and Rare Plants. *Dammann Cat.*—Dammann & Co., En-gros Preis-Liste. *Gard.*—The Garden. *G. C.*—Gardeners' Chronicle. *G. and F.*—Garden and Forest. *Gfl.*—Gartenflora. *H. G.*—Hamburger Garten- und Blumenzeitung. *Ill. H.*—L'Illustration Horticole. *Jard.*—Le Jardin. *J. of H.*—Journal of Horticulture. *L.*—Lindenia. *O.*—L'Orchidophile. *R.*—Reichenbachia. *R. H.*—Revue Horticole. *R. H. B.*—Revue de l'Horticulture Belge. *Späth Cat.*—Späth, Haupt-Preis-Verzeichniss. *Veitch Cat.*—Veitch & Sons, Catalogue of Plants. *W. G.*—Wiener Illustrirte Garten-Zeitung. *Williams Cat.*—Williams, New and General Plant Catalogue. *W. O. A.*—Warner & Williams, Orchid Album.

The abbreviations used in the descriptions of the plants are:—*Diam.*—Diameter. *Fl.*—Flower. *Fr.*—Fruit. *Ft.*—Foot or Feet. *G.*—Greenhouse. *H.*—Hardy. *H. H.*—Half-hardy. *In.*—Inches. *Infl.*—Inflorescence. *L.*—Leaves. *Lin.*—Line (one-twelfth of an inch). *Per.*—Perennial. *Pet.*—Petals. *S.*—Stove. *Sep.*—Sepals. *Shr.*—Shrub.

Abies nordmanniana, var. **pendula,** Hort. (*R. H.* 1890, p. 440, f. 132.) Coniferæ. Garden variety with drooping branches. (Courtois, Clamart, Seine.)

***Aconitum Fischeri,** Reichb. (*B. M.* t. 7130.) Ranunculaceæ. A beautiful hardy species, nearly allied to the Chinese *A. Fortunei,* differing chiefly by its longer not semicircular hood, and more robust habit. Syn. *A. californicum,* Hort. N.E. Asia, Japan, and N. Amer. (Max Leichtlin; Kew.)

Acropera Loddigesii, Ldl. var. **atropurpurea,** Regel. (*Gfl.* 1890, p. 507.) Orchideæ. S. A fine variety with dark purple sep., and deep yellow pet. and lip, dotted with black. (St. Petersburg Botanic Garden.)

Adiantum lambertianum. (*W. G.* 1890, p. 345.) Filices. S. A variety of *A. cuneatum,* having the very small ultimate segments much crumpled and curled. (Pynaert van Geert.)

Adiantum manicatum, Hort. (*Gard.* 1890, xxxviii., p. 94.) S. A seedling "with bold broad fronds and much divided pinnules." (Birkenhead.)

Aeranthus brachycentron, Regel. (*Acta Horti Petrop.* 1890, v. 11, p. 303.) Orchideæ. S. A dwarf species with oblong-ligulate l. 6–8 in. long, unequally bilobed at the apex. Scape slender, twice as long as the l., bearing 1–2, pale yellow fl. Sep. with long slender points. Lip cordate-ovate, cuspidate, with a short, clavate, incurved spur. Comoro Isles? Distributed by Sander & Co.

as *A. grandidieranus*. (St. Petersburg Botanic Garden.)

Aerides augustianum, Rolfe. (*G. C.* 1890, vii., p. 9; *L.* v. 5, p. 39, pl. 210; *Gfl.* 1890, p. 256.) Orchideæ. S. Allied to *A. Roebeleni*, Rchb. f., but differs in its longer spur and in having rose-coloured flowers, instead of greenish white. Philippine Islands. (L'Horticulture Internationale.)

*__Aerides Jansoni,__ Rolfe. (*G. C.* 1890, viii., p. 66; *O.* 1890, p. 193.) S. A supposed natural hybrid between *A. odoratum* and *A. expansum*. Burmah. (Low & Co.)

Agave maximowicziana, Regel. (*Acta Horti Petrop.* 1890, v. 11, p. 303.) Amaryllidaceæ. G. succulent. Allied to *A. densiflora* with a dense rosette of subovate-lanceolate l., 3½ in. broad, densely and irregularly toothed, the terminal spine sometimes forked. Fl.-stem 6–7 ft. high, with a cylindric spike of sessile green fl. in pairs. (St. Petersburg Botanic Garden.)

Agrostemma Walkeri, Dickson. (*Gfl.* 1890, p. 529.) Caryophyllaceæ. H. A garden hybrid between *A. coronaria* and *A. flos-jovis*. (Dicksons, Chester.)

Alocasia Gaulainii, André. (*W. G.* 1890, p. 380.) Aroideæ. S. A robust plant with cordate l.; dark green above with a silvery hue along the nerves, light violet beneath with blackish nerves.

Alocasia reversa, N. E. Br. (*G. C.* 1890, viii., p. 38.) S. An attractive foliage plant, less than a foot high, with ovate-sagittate leaves, coloured grey-green, the primary veins being broadly bordered with dark green. Philippine Islands. (Sander & Co.)

Androsace britanica, Backh. (*W. G.* 1890, p. 34.) Primulaceæ. H. alpine, growing to 2 in. in height, with white fl. (Backhouse & Son, York.)

*__Androsace cylindrica,__ DC. (*W. G.* 1890, p. 34.) H. alpine, of moderately robust habit, with lanceolate-oblong, obtuse, pubescent l. growing to ½ in. long, and pure white fl. (Vienna Botanic Garden.)

Androsace wulfeniana, Leyb. (*W. G.* 1890, p. 35.) H. alpine, a form of **A. alpina,** but with the l. less pubescent, and large rosy-purple fl. (Vienna Botanic Garden.)

*__Anemone caffra,__ Eckl. and Zey. (*G. C.* 1890, vii., p. 389.) Ranunculaceæ. G. Leaves palmately lobed, 8 in. across, dark green. Flowers white, 3 in. across, on scapes 15 in. high. S. Africa. (Kew.)

Anemopægma clematideum, Griseb. *See* **Pithecoctenium.**

*__Angræcum henriquesianum,__ Rolfe. (*G. C.* 1890, viii., p. 466; *H. G.* 1890, p. 555.) Orchideæ. S. Closely allied to *A. bilobum*, Lindl., but a much smaller plant in every respect. St. Thomas' Island. (Coimbra Botanic Garden.)

*__Angræcum pallidum.__ (*G. and F.* iii., p. 78; *W. G.* 1890, p. 156.) S. A species in the way of *A. pellucidum*, but with leaves 2 feet long, and numerous long spikes of white flowers. West Africa. (Wallace, Colchester.)

Angræcum primulinum, Rolfe. (*G. C.* 1890, vii., p. 388.) S. Intermediate between *A. hyaloides* and *A. citratum*. Madagascar. (Low & Co.)

*__Anthurium Baron Hruby,__ N. E. Br. (*G. C.* 1890, viii., p. 652; *H. G.* 1890, p. 557.) Aroideæ. S. A hybrid between *A. ferrierense* and *A. splendidum*. (Baron Hruby, Bohemia.)

Anthurium excelsior, Hort. (*W. G.* 1890, p. 307, with plate.) S. A hybrid between *A. Veitchii* and *A. ornatum*. Garden hybrid.

Anthurium Hero, N. E. Br. (*G. C.* 1890, viii. p. 652; *H. G.* 1890, p. 557.) S. A hybrid between *A. Veitchii* and *A. crystallinum*, raised by W. Bull, Chelsea.

Anthurium scherzerianum, var. **bispathaceum,** Rod. (*Ill. H.* v. 37, p. 67, pl. 107; *W. G.* 1890, p. 397.) S. A curious form with two red spathes placed opposite each other. Garden variety. (L'Horticulture Internationale.)

Anthurium scherzerianum, var. **maximum, album,** Rodig. (*Ill. H.* v. 37, p. 29, pl. 100.) S. A seedling variety with large white spathes. (L'Horticulture Internationale.)

*__Aquilegia atrata,__ Koch. (*W. G.* 1890, p. 161.) Ranunculaceæ. H. A form of *A. vulgaris* with dark violet fl. Germany.

*__Aquilegia oxysepala,__ Traut. (*W. G.* 1890, p. 208.) H. per. Much like *A. vulgaris*, but with larger l., and the sep. very narrow, and very acute. Also known as *A. oxypetala*. Siberia.

***Arisæma anomalum**, Hemsley. (*G. C.* 1890, vii., p. 321.) Aroideæ. S. A small species, remarkable in having an Iris-like rhizome and in being evergreen. Leaves 9 in. high, green, with 3–5 lanceolate leaflets. Scape 9 in. high, spathe small, coloured greenish-white and brown. Perak. (Kew.)

Aristolochia longicaudata, Masters. (*G. C.* 1890, viii., p. 493, fig. 98.) Aristolochiaceæ. S. A robust climber with the habit and leaves of *A. brasiliensis*, and large flowers. "It is a handsome species of the unilabiate group, in which the solitary lip of the flower is prolonged into a very long tail." Colour creamy-white with purple veins. British Guiana. (Todd, North Cray.)

***Asarum caudigerum**, Hance. (*G. C.* 1890, vii., p. 422; *B. M.* t. 7126.) Aristolochiaceæ. G. A dwarf arum-like plant with cordate hairy green leaves, and short-stalked green and brown flowers, the three segments narrowed into tails an inch long. Southern China. (Kew.)

***Asarum geophilum**, Hemsl. (*G. C.* 1890, vii., p. 422.) G. Leaves cordate-orbicular, 2–4 in. across, green with white veins. Flowers resting on the ground, brown with white spots. South China. (Kew.)

Asparagus retrofractus arboreus, Hort. (*Jard.* 1890, p. 255, with fig.). Liliaceæ. G. An ornamental asparagus something in the way of *A. plumosus*, &c. but with straighter stems, and with the l. (cladodia) $\frac{3}{4}$–1 in. long. (Lemoine.)

Asparagus Sprengeri, Rgl. (*Gfl.* 1890, p. 490, f. 80; *Acta Horti Petrop.* v. 11, p. 302; *H. G.* 1890, p. 503.) G. A useful decorative plant, something in the way of *A. sarmentosus* and *A. falcatus*, but with the flat linear cladodia (false leaves) placed 1–4 together, nearly straight or only slightly falcate, $\frac{1}{2}$–1$\frac{1}{2}$ in. long, pungent-mucronate. Natal. (Dammann & Co.)

Atriplex halimoides, var. **monumentalis**, Spreng. (*B. T. O.* 1890, p. 42, fig. 3; *Gfl.* 1890, p. 105, f. 24.) Chenopodiaceæ. H. A seedling form of tall habit, growing to 9 or 10 ft. high. Syn. *A. nummularia*, var. *monumentalis*. Dammann Cat. 1890–91, p. 87, f. 58. (Dammann & Co.)

***Atriplex nummularia**, Lindl. (*Dammann Cat.* 1890–91, p. 87.) H. H. A much branched shrubby plant growing to 9 or 10 ft. in height with silvery-white l. and fl. Australia. (Dammann & Co.)

***Barbacenia squamata**, Paxt. (*G. C.* 1890, viii., p. 408, fig. 81; *H. G.* 1890, p. 554.) Amaryllideæ. A pretty flowered stove plant, with slender stems, narrow grassy leaves, and star-shaped flowers, coloured bright red. Introduced by Veitch from Brazil in 1841 but soon afterwards lost. It was re-introduced through Kew last year.

Barleria involucrata, Nees, var. **elata.** (*G. C.* 1890, vii., p. 448; *Gfl.* 1890, p. 448.) Acanthaceæ. S. A compact shrub 6 ft. high when wild, and of showy appearance. Flowers 2$\frac{1}{4}$ in. across, dark blue. Singapore. (J. Veitch & Sons.)

Begonia Baumanni, Lemoine. (*Jard.* 1890, p. 273, with fig.; *G. C.* 1890, v. 8, p. 466; *H. G.* 1890, p. 555.) Begoniaceæ. G. An elegant species with the habit of *B. socotrana*, having a tuberous rootstock which produces short fleshy stems, bearing a few reniform dark green l. that are bronzy or purplish beneath, and erect, leafless, purplish peduncles 12–18 inches high, bearing about five large carmine-rose fl. 3–4 inches in diameter, and agreeably scented. (Lemoine.)

Begonia Credneri, Haage & Schm. (*Gfl.* 1890, p. 562, f. 90; *H. G.* 1890, p. 482, with fig.) G. or S. A garden hybrid between *B. Scharffiana* and *B. metallica*. (Haage & Schmidt.)

Begonia Jaurezi, Laing. (*H. G.* 1890, p. 364.) G. or S. A garden variety with semi-double fl. (Laing & Sons.)

Begonia scharffiana metallica. (*G. C.* 1890, viii., p. 416.) G. A hybrid raised by Messrs. Haage & Schmidt. Erfurt. (*See* **B. Credneri.**)

***Berberis Sieboldii**, Miq. (*G. and F.* v. III., p. 249, f. 38.) Berberideæ. H. This chiefly differs from the common Barberry in having ciliate margins to the leaves, and in the rather larger, paler-coloured flowers. Japan.

Berberis virescens, Hook. fil. (*B. M.* 7116.) The correct name for the plant cultivated in gardens as *B. Belstaniana*.

***Betula pumila**, L. var. **Grayi**, Hort. Zöschen. (*Engros-Catalog des National-Arboretum Zöschen*, 1890, p. 19.) Cupuliferæ. H. shr. with roundish shining green l.; no other description, and is probably not the *B. Grayi*, Rgl., which has the young l. and shoots densely pubescent. British Columbia. (Zöschen Arboretum.)

***Bignonia rugosa,** Schl. (*B.M.,t.*7124.) Bignoniaceæ. S. A climber covered with soft hairs; leaves bifoliate; flowers in axillary cymes, calyx broad, urn-shaped, corolla funnel-shaped, yellow with a creamy white limb. Caraccas. (Kew.)

Billbergia perringiana, Wittm. (*Gfl.* 1890, p. 145, t. 1318.) Bromeliaceæ. S. A garden hybrid between *B. nutans* and *B. liboniana.* (Botanic Garden, Berlin.)

Billbergia quintusiana, Makoy. (*Gfl.* 1890, p. 202, f. 49.) S. Something in the way of *B. Saundersii*, but with larger l., which are of a clearer green, not coloured brown beneath and with fewer bars and spots, and the flower spike is thicker and erect, not drooping. Bracts carmine-red. Fl. with a greenish calyx tinged with rosy, and greenish pet. tipped with blue. Brazil. (Jacob-Makoy.)

Billbergia vittata, Brongn. var. **Rohani,** Wittm. (*Gfl.* 1890, p. 306, f. 60.) S. Is undistinguishable from the type. (Berlin Botanic Garden.)

Bougainvillea speciosa, var. **variegata,** Williams. (*Williams Cat.* 1890, p. 24; *W. G.* 1890, p. 351.) Nyctagineæ. G. or S. A form with variegated foliage. Garden variety. (Williams & Son.)

***Brodiæa Hendersoni,** S. Wats. (*Gfl.* 1890, p. 425.) Liliaceæ. H. bulb with linear l. 12–15 in. long, and a scape of about the same length bearing an umbel of clear yellow fl. striped with green outside, and with violet-purple midribs, anthers bluish. Western North America. (T. S. Ware.)

Buckleya distichophylla, Torr. (*G. and F.*, vol. III., p. 237, f. 37; *W. G.* 1890, p. 293.) Santalaceæ. H. A shrub 10–12 ft. high with slender graceful spreading branches, and light green delicate foliage: fl. and fr. inconspicuous. One of the rarest of North American plants. (Botanic Garden, Cambridge, Mass.)

Bulbophyllum lemniscatoides, Rolfe. (*G. C.* 1890, vii., p. 672.) Orchideæ. S. Differs only from *B. lemniscatum*, Parish, in habit and in the structure of the appendages to the sepals. Java. (Van Lansberge, Brummen Guildre.)

Calanthe Mylesii, Williams. (*W.O.A.*, v. 9, pl. 402; *Williams Cat.* 1890, p. 25; *Gfl.* 1890, p. 395.) Orchideæ. S. A garden hybrid between *C. nivalis* and *C. Veitchii.* Fl. pure white. (Lady Hutt, Ryde, I. of Wight.)

Calanthe rubens, Ridley. (*G. C.* 1890, vii., p. 576.) S. A small species allied to *C. vestita.* "It flowers readily and "well, the flowers being numerous, "pretty, and lasting a long time." The scapes are 2 ft. long, and they each bear about a dozen rose-coloured flowers. Malay Peninsula.

Calanthe Veitchii alba, Rolfe, (*G. C.* 1890, vii., p. 132.) S. A pure white flowered variety, raised by Sir C. Strickland, Malton.

***Calochortus Howellii,** Wats. *G. and F.*, v. 3, p. 348.) Liliaceæ. H. A showy species with handsome white fl. 1 in. broad, and with a dark brown beard on the lower half of the inner segments. Summer. Oregon. (Kew.)

***Calochortus longibarbatus,** Wats. (*G. and F.*, v. 3., p. 324.) H. An interesting species. Stems 1 ft. high with 1–3 pale purple flws. 1½ in. in diam., with a dark purple stripe across the base of each segment and a beard an inch long above it. July. Oregon and Washington. (Kew.)

***Calochortus madrensis,** Wats. (*G. C.* 1890, v. 8, p. 391, f. 78.) H. A handsome free flowering species, with bright orange-yellow flowers, and a band of deep orange hairs at the base of each segment; l. linear. September. (Kew.)

***Calpurnia lasiogyne,** E. M. (*G. C.* 1890, vii., p. 389.) Leguminosæ. G. A small tree with the habit, leaves, and flowers of Laburnum, known in Natal as Natal Laburnum. (Kew.)

***Carludovica Caput Medusæ,** Hook. f. (*Bot. Mag.*, t. 7118; *Gfl.* 1890, p. 539.) Cyclanthaceæ. A handsome stove plant with broad, plicate, lobed leaves, 5 to 7 feet long, and heads of white filamentose flowers. Native country doubtful. (Kew.)

Cassia Barrenfieldii, Colla. (*Dammann Cat.* 1890–91, pp. 76 and 79, f. 46.) Leguminosæ. H. H. or G. per. A synonym of **C. australis,** Sims. (Dammann & Co.)

Cassia Reinwardtii, Hassk. (*Dammann Cat.* 1890–91, p. 78.) H. H. or G. A synonym of **C. bicapsularis,** L. (Dammann & Co.)

Catalpa bignonioides, vars. **aurea, foliis argenteis variegatis, grandiflora,** and **purpurea,** Hort. (*W. G.* 1890, p. 315.) Bignoniaceæ. H. Garden varieties.

***Catalpa cassinoides,** Hort. (*W. G.* 1890, p. 316.) H. A form having l. intermediate between those of *C. speciosa* and *C. Bungei.* (Zöschen Arboretum.)

Catalpa cordifolia, Hort., not of Nutt. (*W. G.* 1890, p. 316.) This is thought to be the same as **C. bignonioides,** Walt.

***Catalpa pumila,** Hort. (*W. G.* 1890, p. 317.) No description. (Zöschen Arboretum.)

Catalpa Thunbergii, Hort. (*W. G.* 1890, p. 318.) No description. (Distributed by Späth.)

Catalpa wallichiana, Hort. (*W.G.* 1890, p. 318.) It is thought to be a Chinese form of *C. Kaempferi*, and is of rather low growth. Also known as *C. Kaempferi*, var. *nana*, Hort. (Dieck.)

Catasetum Bungerothi, N.E. Br. var. **Randi,** Rodigas. (*Ill. H.* v. 37, p. 117, pl. 117.) Orchideæ. S. A handsome yellow-flowered form with a spot of deep apricot yellow in the spur. (L'Horticulture Internationale.)

Catasetum rodigasianum, Rolfe. (*L.* v. 6, p. 41, pl. 259.) S. An interesting species, with a long raceme of rather large fl. The sepals are green spotted with brown on the outside, and almost entirely brown inside; the pet. are green spotted with brown; and the concave lip is three toothed in front, and of a yellow colour spotted with purple-brown, Santa Catharina, Brazil. (L'Horticulture Internationale.)

Cattleya ballantiniana, Hort. Sander. (*R.* vol. 2, t. 91.) Orchideæ. S. A hybrid raised by Sander & Co. from *C. Trianæ* and *C. Warscewiczii.*

Cattleya Empress Frederic, Hort. (*Gard.* xxxviii., p. 43.) S. Said to be a hybrid between *C. Mossiæ* and *C. Dowiana.* (Baron Schroeder.)

Cattleya gaskelliana, var. **picta,** Rolfe. (*G. C.* 1890, viii., p. 352; *H. G.* 1890, p. 504.) S. Distinct in having variegated sepals and petals. (J. Chamberlain, M.P.)

Cattleya granulosa, var. **buyssoniana,** O'Brien. (*G. C.* 1820, viii., p. 588, fig. 116; *H. G.* 1890, p. 556.) S. Distinct from the type in having ivory white sepals and petals. Habitat not published. (L'Horticulture Internationale.)

Cattleya intermedia, Grah. var. **candida splendida,** Rgl. (*Gfl.* 1890, p. 1, t. 1313.) S. A variety with pure white fl., except the front lobe of the lip, which is carmine-purple. Rio Janiero. (St. Petersburg Bot. Gard.)

Cattleya intricata, Rchb. f. var. **maculata,** Rolfe. (*G. C.* 1890, vii., p. 763.) S. The type is supposed to be a natural hybrid between *C. intermedia* and *C. guttata.* The variety has flowers coloured delicate rosy blush with purplish spots. Brazil. (M. Cook, Kingston Hill.)

***Cattleya labiata,** Lindl., var. **warocqueana.** Rolfe. (*G. C.* 1890, vii., p. 735; *O.* 1890, p. 161.) S. Another addition to the numerous forms of this Cattleya. Habitat not published. Syn. *C. warocqueana*, Lind. (L'Horticulture Internationale.)

Cattleya Lindeni, Hort. Lind. (*J. of H.* 1890, xxi., p. 471, fig. 64.) S. Probably a variety of *C. gigas.* The sepals and petals are rose coloured, with white veins, and the lip magenta-crimson, bright yellow, with undulated margin. (L'Horticulture Internationale.)

Cattleya maxima, var. **malouana,** Linden. (*L.* v. 5, p. 41, pl. 211.) S. A handsome form with short bulbs and dark coloured fl. (L'Horticulture Internationale.)

Cattleya maxima, Lindl., var. **marchetiana,** Williams. (*W. O. A.* v. 9, pl. 404.) S. A splendid variety, with dark coloured fl., the dark rosy-purple ground colour being heavily blotched and veined with dark magenta-purple, the throat and mid-line of the lip being clear yellow. Ecuador, Peru. (G. Marchetti, Manor Heath, Halifax.)

Cattleya obrieniana, Hort. (*J. of H.* 1890, xx. p. 25, fig. 4.) S. A rose-tinted variety of *C. intermedia.*

Cattleya Rex, O'Brien. (*G. C.* 1890, viii., p. 684; *H. G.* 1890, p. 557.) S. A handsome flowered plant of the labiata group, and probably a variety of *C. aurea*, being most like *C. aurea*, var. *imschootiana.* Habitat not published. (L'Horticulture Internationale.)

Cattleya superba, var. **alba,** Rolfe. (*G. C.* 1890, viii., p. 620; *H. G.* 1890, p. 556.) S. Described as having pure white flowers. Brazil. (E. S. Rand, Para.)

Cattleya Trianæ, var. **fulgens,** Hort. (*G. C.* 1890, vii., p. 336.) S. "A "finely formed variety with rich crimson "labellum." (G. Firth, Bradford.)

Cattleya Trianæ, var. **Madame Martin-Cahuzac,** Linden. (*L.* v. 5, p. 79, pl. 230.) S. A beautiful form, with the fl. of a pale and delicate rosy tint, except the front of the lip, which is magenta-purple, and the disk yellow, with a white border. (L'Horticulture Internationale.)

Cattleya Trianæ, var. **marginata,** Hort. (*G. C.* 1890, vii., p. 336.) S. Remarkable in having a large labellum, coloured rich crimson, edged with white. (Laing & Sons.)

Cattleya Trianæ, var. **pallida,** Linden. (*L.* v. 5, p. 81, pl. 231.) S. A delicately coloured form, the whole fl. being of a pale rosy-white, with the disk of the lip yellow. (L'Horticulture Internationale.)

Cattleya Trianæ, var. **purpurata,** Linden. (*L.* v. 5, p. 77, pl. 229.) S. A handsome form, with light mauve coloured sep. and pet., and a rich magenta lip with a yellow throat. (L'Horticulture Internationale.)

Cattleya Trianæ, var. **striata,** Linden. (*L.* v. 5, p. 83, pl. 232.) S. A remarkable form, with the sep. and pet. of a rosy purple marked with a broad carmine central stripe; the lip is carmine rose, with a yellow disk. (E. Wallaert.)

Cattleya warocqueana, Lind. (*W. G.* 1890, p. 446; *Gfl.* 1890, p. 448). *See* **C. labiata,** var. **warocqueana.**

Cedrus atlantica, var. **fastigiata,** Carr. (*R. H.* 1890, p. 32, f. 9; *G. C.* 1890, v. 7, p. 197.) Coniferæ. H. Shr. or tree. A variety of pyramidal habit with ascending branches. Garden variety. (Lalande, Nantes.)

***Celmisia Lindsayi,** Hook. f. (*B. M.*, t. 7134; *H. G.* 1890, p. 505.) Compositæ. Hardy, but requiring protection from damp. Stems densely tufted, 3–6 in. long, upper parts leafy, l. 2–4 in. long, oblong lan. obtuse, very coriaceous, dark green and shiny above, white underneath. Fl. stem 5–6 in. high, bracts linear, 1–2 in. long. Fl. 1–2 in. diam. white, ray florets 30–40, tips 3-toothed, disk fl., yellow. New Zealand. (Max Leichtlin; Kew.)

***Celtis reticulata,** Torr. (*Engros-Catalog des National-Arboretum Zöschen*, 1890, p. 19.) Urticaceæ. H. tree, with cordate-ovate l., more or less oblique at the base, very rough above and very strongly reticulate-veined beneath. Texas. (Zöschen Arboretum.)

***Cineraria aurita,** Hort. (*Gard.* xxxviii., p. 252, plate 770.) Compositæ. This is a synonym of **C. lanata,** Curtis. *Bot. Mag.*, t. 53.) It is a pretty spring flowering greenhouse plant with silvery leaves and large elegant racemes of bright purple and white flowers. Canary Islands. (Glasnevin Botanic Garden.)

Cirrhopetalum mastersianum, Rolfe. (*L.*, v. 6, p. 33, pl. 255.) Orchideæ. S. A beautiful species, with ovoid-quadrangular bulbs, each bearing one l. 4–5 in. long by 1 in. broad, and umbels of 6–8 fl. on purplish drooping scapes. The fl. are about 1½ inch in length, and of a deep yellow, with the upper half of the lateral sep. brown, and the lip brownish-purple. Dutch Indies. (L'Horticulture Internationale.)

***Cissus mexicana,** Damm. (*Dammann Cat.* 1890-91, p. 25.) Ampelideæ. H. H. A vine with tuberous rootstock, producing annual deciduous stems, with leaves something like those of the common vine, and bunches of large red or white grapes of a fine flavour. Sinalva, Mexico. (Dammann & Co.)

***Clematis Stanleyi,** Hook. (*G. C.* 1890, viii., p. 326, fig. 66; *W. G.* 1890, p. 453; *H. G.* 1890, p. 504; *G. and F.* iii. 513, fig. 65.) G. A shrub 3 ft. high with bipinnate silvery foliage and axillary flowers; these are cup-shaped, 2½ inches across, fleshy, and coloured rosy-white to purple. South Africa. (Kew.)

***Colchicum procurrens,** Baker. (*G. C.* 1890, v. 7, p. 192; *Gfl.* 1890, p. 255.) Liliaceæ. H. One of the Blastodes section, and closely allied to *C. Boissieri.* Fl. bright lilac, produced in October. L. linear, produced in February. Rhizome resembling that of a Merendera. Syn. *Merendera sobolifera,* Hort. Smyrna. (Kew.)

***Colchicum Sibthorpii,** Baker. (*G. C.* 1890, v. 8, p. 388.) H. A handsome species, with fl. as large as those of *C. speciosum.* Fl. 3–4 in a spathe, tessellated with lilac-purple, l. broadly strap-shaped, appearing in spring. October. Armenia. Syn. *C. latifolium,* Sibth. & Sm. (Max Leichtlin.)

Cordyline indivisa, var. **dalliereana,** Hort. (*Ill. H.*, v. 37, p. 99, pl. 114.) Liliaceæ. G. An ornamental seedling variety, having the l. striped with yellowish. (Dallière, Ghent.)

Coryanthes Bungerothi, Rolfe. (*L.*, v. 6, p. 11, pl. 244; *G. C.*, 1890, v. 8, p. 210; *Gfl.* 1890, p. 647.) Orchideæ. S. A fine species of this singular genus, with very large fl. Sep., pale green dotted with red; pet., white with larger red spots. The lip has the front part of the very large hood-like organ prolonged down to the level of the bucket-shaped part, it is of an orange colour, spotted inside with red-brown, the bucket-shaped part is yellow shading to yellowish brown, and marked inside with large red-brown spots. Venezuela. (L'Horticulture Internationale.)

***Cosmos bipinnatus**, Cav. var. **albiflorus**, Sprenger. (*B. T. O.* 1890, p. 356.) Compositæ. H. Annual. A variety with white fl. (Dammann & Co.)

Cotoneaster sikkimensis, Hort. (*W. G.* 1890, p. 248.) Rosaceæ. H. Deciduous shr. of vigorous growth, with large elliptic l. 4–5 in. long by 2–2½ in. broad, entire, mucronate, dull green above, grey beneath. Fl. in compound umbels, white. Fr. globose, bright coral-red. Sikkim. (Agricultural School, Grignon.)

***Crassula recurva**, N. E. Br. (*G. C.* 1890, viii., p. 684; *H. G.*, 1890, p. 557.) Crassulaceæ. G. A new species in the way of *C. rubicunda;* leaves, greyish-green, mottled with purplish-crimson. Stems a foot high. Flowers in flat-topped cymes, crimson. Zululand. (Kew.)

Cratægus grignoniensis, Mouillefert. (*W. G.* 1890, p. 248.) Rosaceæ. H. Shr. with lanceolate l., and yellowish-green or lemon-yellow fr., tinted with reddish. (Agricultural School,Grignon.)

Crinum kunthianum, Dammann. (*W. G.* 1890, p. 358, f. 76.) Amaryllidaceæ. S. Bulb, with a large rosette of lanceolate l., 12–20 in. long, wavy on the margin. Peduncle about as long as the l., bearing 4–7 large white fragrant fl., marked with a red stripe down each segment. (Dammann & Co.)

Cucumis Sacleuxii. (*W. G.* 1890, p. 298.) Cucurbitaceæ. S. An ornamental cucumber with roundish reniform lobed l., rough and greyish-green on both sides. The fruit is ovoid, 3–4 in. long, of a dark green with lighter green stripes, used for pickling. Zanzibar. (Paillieux and Bois; Jardin des Plantes, Paris.)

***Cucurbita mexicana**, Damm. (*Dammann Cat.* 1890–91, p. 42.) Cucurbitaceæ. H. H. or S. climber, very similar to *C. melanosperma*, but with the l. of a different shape, and fl. of a different hue, the seeds are large and black. Mexico. (Dammann & Co.)

Cydonia vulgaris, var. **marmorata**, Späth. (*Späth Cat.* 1889–90, p. 3.) Rosaceæ. H. Shr. A garden variety, having the l. variegated with white and yellow. (Späth.)

Cymbidium Loise Chauvieri, Hort. Sand. (*G. and F.*, iii., p. 153.) Orchideæ. S. Introduced by Sander & Co., and described by them as "A large-flowered scarlet variety, from Madagascar."

Cymbidium tracyanum, Hort. (*G. C.* 1890, viii., p. 718; *J. of H.* xxi., 3rd ser., p. 535, fig. 71.) S. A large flowered variety of *C. grandiflorum*, Griff. (*C. hookerianum*, Rchl. f.) Introduced amongst *C. lowianum*, and flowered by H. Tracy, Twickenham.

***Cyperus natalensis**, Hort. (*G. and F.* iii., p. 469.) Cyperaceæ. S. A plant well known in gardens under this name, recently flowered at Kew, and was determined by Mr. C. B. Clarke as "certainly not *C. natalensis*, but a "Mariscus, allied to, if not a variety of, "*M. sparganifolius*."

Cypripedium Alcides, Hort. Sand. (*G. C.* 1890, viii., p. 702, and ix., p. 40.) Orchideæ. S. A hybrid between *C. insigne* and *C. hirsutissimum;* raised by F. Sander & Co.

C. Alfredi. N. E. Br. (*G. C.* 1890, viii., p. 294; *H. G.* 1890, p. 503.) S. A hybrid between *C. venustum* and *C. laevigatum.* (D. O. Drewitt, Riding, Mill-on-Tyne.)

Cypripidium Alice, N. E. Br. (*G. C.* 1890, viii., p. 294; *H. G.* 1890, p. 503.) S. A hybrid between *C. Stonei* and *C. spicerianum.* (D. O. Drewitt, Riding, Mill-on-Tyne.)

Cypripedium Antigone, Rolfe. (*G. C.* 1890, viii., p. 716; *H. G.* 1890, p. 557.) S. A hybrid between *C. lawrencianum* and *C. niveum;* raised by J. Veitch & Sons.

Cypripedium arnoldianum, W. A. Manda. (*G. C.* 1890, viii., p. 632.) S. A hybrid between *C. Veitchii* and *C. concolor.* (Pitcher and Manda, Short Hills, New Jersey.)

Cypripedium Aylingii, L. Castle. (*J. of H.* 1890, xx., p. 480, fig. 74; *G. C.* 1890, vii., p. 792.) S. A garden hybrid raised from *C. niveum* and *C. ciliolare.* (A. J. Hollington, Enfield.)

Cypripedium barbatoveitchianum, Bleu. (*L.* v. 5, p. 75, pl. 228.) S. A garden hybrid between *C. barbatum* and *C. superbiens.* (A. Bleu.)

Cypripedium castleanum, Rolfe. (*G. C.* 1890, viii., p. 702, and ix. p. 39.) S. A hybrid between *C. hirsutissimum* and *C. superbiens*; raised by Sander & Co.

Cypripedium Constance, N. E. Br. (*G. C.* 1890, viii., p. 294; *J. of H.* xxi., 3rd ser., p. 353, fig. 40; *H. G.* 1890, p. 503.) S. A hybrid from *C. Stonei* and *C. Curtisii.* (D. O. Drewitt, Riding, Mill-on-Tyne.)

Cypripedium Cythera, Rolfe. (*G. C.* 1890, vii., p. 73.) S. A hybrid from *C. spicerianum* and *C. purpuratum.* (R. H. Measures.)

Cypripedium deboisianum, Ch. de B. (*G. C.* 1890, viii., p. 747.) S. A hybrid between *C. venustum* and *C. Boxalli*, var. *atratum*; raised by Vervaet et Cie, Mont St. Amand.

Cypripedium Doris, Rolfe. (*G. C.* 1890, viii., p. 716; *H. G.* 1890, p. 557.) S. A hybrid between *C. venustum* and *C. Stonei*; raised by N. C. Cookson.

Cypripedium Elinor, N. E. Br. (*G. C.* 1890, viii., p. 38.) S. A hybrid between *C. selligerum majus* and *C. Veitchii.* (D. O. Drewitt.)

Cypripedium eyermanianum, Rolfe. (*G. C.* 1890, viii., p. 746; *H. G.* 1890, p. 558.) S. A hybrid between *C. barbatum* and *C. spicerianum*; raised by F. Sander & Co.

Cypripedium Fraseri, Hort. (*L.* v. 6, p. 29, pl. 253.) S. A garden hybrid between *C. hirsutissimum* and *C. barbatum?* (Jules Hye.)

Cypripedium George Kittel, Wittm. (*Gfl.* 1890, p. 311.) S. A garden hybrid between *C. dayanum*, var. *superbum* and *C. Veitchii.* (Kittell, Eckersdorf, Silesia.)

Cypripedium germinyanum. (*J. of H.* xxi., 3rd ser., p. 89, fig. 12.) S. A hybrid from *C. hirsutissimum* and *C. villosum.* (J. Veitch & Sons.)

Cypripedium Godefroyæ, var. **Laingi.** (*O.* 1890, p. 129.) S. A variety with small fl., the upper sep. very short and broad, the lower sep. small, and almost orbicular, and the pet. narrowly elliptic or oblong, colours similar to the type. (Laing & Sons.)

Cypripedium H. Ballantine. Rolfe. (*Garden* xxxviii., p. 166; *G. C.* 1890, viii., p. 408; *H. G.* 1890, p. 554.) S. A hybrid between *C. purpuratum* and *C. faireanum*; raised by J. Veitch & Sons.

Cypripedium Hera, Rolfe. (*G. C.* 1890, vii., p. 105.) S. A hybrid from *C. spicerianum* and *C. villosum.* (R. H. Measures.)

Cypripedium Hookeræ, Rchb. f., var. **volonteanum,** Rolfe. (*G. C.* 1890, viii., p. 66.) S. Leaves narrower, petals broader and more obtuse than in the typical form. Borneo. (Low & Co.; Sander & Co.)

Cypripedium insigne, var. **longisepalum,** Hort. Sand. (*G. C.* 1890, viii., p. 702, and ix., p. 72.) S. A pale coloured variety, with the sepals slightly longer than in the type. (Sander & Co.)

Cypripedium insigne, var. **Macfarlanei,** Rolfe. (*G. C.* 1890, viii., p. 655.) S. Flowers soft bright yellow, dorsal sepal with a white margin, and without the brown spots of the type. (R. H. Measures, Streatham.)

Cypripedium lathamianum, Rchb. f., var. **inversum,** Rolfe. (*R.*, 2nd ser., v. 1, p. 21, t. 10.) A synonym of **C. Hera.**

Cypripedium leeanum, var. **biflorum,** N. E. Br. (*G. C.* 1890, vii., p. 161.) Raised from *C. insigne*, var. *Chantini* and *C. spicerianum* by D. O. Drewitt, Riding, Mill-on-Tyne.

Cypripedium leeanum, var. **giganteum,** Rolfe. (*G. C.* 1890, viii., p. 718.) S. A very large flowered variety obtained by Heath & Son of Cheltenham from *C. spicerianum* crossed with *C. insigne.*

Cypripedium Maynardii, Hort. Sand. (*G. C.* 1890, viii., p. 702.) S. A hybrid between *C. purpuratum* and *C. spicerianum*; raised by F. Sander & Co.

Cypripedium Morganiæ, Rchb. f., var. **burfordiense,** Sander. (*R.* 2nd ser., v. 1, p. 1, t. 1.) A richly coloured form of this garden hybrid. (Sir Trevor Lawrence.)

Cypripedium northumbrian, N. E. Br. (*G. C.* 1890, vii., p. 160.) A hybrid from *C. calophyllum*, and *C. insigne*, var. *Maulii.* (D. O. Drewitt, Riding, Mill-on-Tyne.)

Cypripedium Numa, Rolfe. (*G. C.* 1890, vii., p. 608.) S. A hybrid, raised by J. Veitch and Sons from *C. laurencianum* and *C. Stonei.*

Cypripedium Œnone, Rolfe. (*G. C.* 1890, vii., p. 260; *O.* 1890, p. 66.) S. Raised by F. Sander & Co. from *C. Hookeræ* and *C. superbiens.*

Cypripedium pollettianum, Hort. Sand. (*G. C.* 1890, viii., p. 702.) S. A hybrid between *C. calophyllum* and *C. venustum superbum;* raised by F. Sander & Co.

Cypripedium præstans, Rchb. f., var. **kimballianum,** Linden. (*L.* v. 6, p. 21, pl. 249.) S. A handsome form with richly coloured fl., the stripes are more numerous and broader, and the spots larger than in the type. (L'Horticulture Internationale.)

***Cypripedium schomburgkianum.** (*G. C.* 1890, vii., p. 336.) S. A small species with linear leaves and elegant flowers. It is very near *C. caricinum.* British Guiana. (Sander & Co.)

Cypripedium siamense, Rolfe. (*G. C.* 1890, vii., p. 161; *Gfl.* 1890, p. 257.) S. A new species with tessellated leaves and green and purple flowers. "It stands nearest to *C. javanicum,* Reinw." Siam. (J. Garden, Bois Colombes, Paris.)

Cypripedium Vipani, Rolfe. (*G. C.* 1890, vii., p. 792.) S. A hybrid, raised by Captain Vipan, Wansford, from *C. philippinense* and *C. niveum.* It is very similar to *C. Aylingi.*

Cypripedium youngianum, Rolfe. (*G. C.* 1890, viii., p. 183.) S. A hybrid between *C. superbiens* and *C. Roebeleni.* (Sander & Co.)

Dendrobium Aspasia, Hort. Veitch. (*G. C.* 1890, vii., p. 336.) Orchideæ. S. A hybrid between *D. aureum* and *D. wardianum.* (J. Veitch & Sons.)

Dendrobium atroviolaceum, Rolfe. (*G. C.* 1890, vii., p. 512; *Gfl.* 1890, p. 450; *O.* 1890, p. 130.) S. Allied to *D. macrophyllum,* differing in the brighter colours, and absence of hairs on its flowers. New Guinea. (J. Veitch & Sons.)

Dendrobium Cassiope, Rolfe. (*G. C.* 1890, viii., p. 620; *H. G.* 1890, p. 556.) S. A hybrid between *D. japonicum* and *D. nobile;* raised by N. C. Cookson.

Dendrobium galliceanum, Linden. (*L.* v. 6, p. 5, pl. 241.) S. A beautiful plant, very similar to D. thyrsiflorum, with a large and dense raceme of white fl., with the lip of a bright clear yellow. The pet. are much broader than the sep., and slightly crisped on the margins; the lip is very broadly cordate-ovate, with a fringed margin. (L'Horticulture Internationale.)

Dendrobium Juno, Hort. (*G. C.* 1890 vii., p. 88; *J. of H.* xxi., 3rd ser., p. 85, fig. 13.) S. A hybrid between *D. wardianum* and *D. linawianum.* (Sir Trevor Lawrence,)

Dendrobium Luna, Hort. (*G. C.* 1890, vii., p. 88.) S. A hybrid between *D. findlayanum* and *D. Ainsworthii.* (Sir Trevor Lawrence.)

Dendrobium Macfarlanei, Rchb. f. (*Veitch Cat.* 1890, p. 10.) S. "By "far the finest of the New Guinea "Dendrobes yet introduced." Pseudo bulbs less than a foot high; raceme 9 to 12 flowered; flowers four inches across, pure white, marked with purple on the sides and base of the lip. (J. Veitch & Sons.)

Dendrobium mirbelianum, Gaud. (*L.* v. 5, p. 49, pl. 215.) S. A distinct looking plant with stout stems, 18–20 in. long, elliptic coreaceous l., and erect racemes bearing about a dozen moderate sized fl. The narrow lanceolate, acute sep. and pet., are greenish-yellow with darker lines. The lip has the oblong side lobes enclosing the column of a greenish-yellow marked with brown lines, and the ovate acute front lobe has a pale disk, and the borders veined with brown. New Guinea. (L'Horticulture Internationale.)

Dendrobium phalænopsis, Rchb. f. var. **statterianum,** Sander. (*R.*, 2nd ser., v. 1, p. 15, t. 7.) S. Does not appear to differ in any way from the type. Timor Laut. (T. Statter, Stand Hall, Manchester.)

Dendrobium Venus, Rolfe. (*G. C.* 1890, vii., p. 608.) S. A hybrid, raised by N. C. Cookson, Wylam-on-Tyne, from *D. Falconeri* and *D. nobile.*

Dendrobium xanthocentrum, Hort. (*G. C.* 1890, vii., p. 88.) S. A hybrid between *D. findlayanum* and some other species. (Sir Trevor Lawrence.)

***Dipladenia atropurpurea,** D.C. (*G. and F.* iii., p. 469.) Apocynaceæ. S. Introduced by Veitch 50 years ago, but lost and forgotten again until it reappeared last year at Kew and elsewhere. It has small ovate leaves, and flowers as large as those of *D. boliviensis,* but coloured deep velvety maroon.

***Dodecatheon Clevelandi,** Greene. (*W. G.* 1890, p. 401.) Primulaceæ. H. per. Allied to *D. meadia,* growing 12–16 in. high, having violet blue fl., with a yellow and black centre. California.

Echinocactus durangensis, Bunge. (*H. G.* 1890, p. 231.) Cactaceæ. G. succulent, with a cylindrical stem 3–10 in. high, having about 21 continuous ribs, armed with yellowish spines tipped with brown ¾–1½ in. long. Fl. brownish red, similar to those of *E. Wrightii*, but brighter. Mexico. (Bunge, San Antonio, Texas.)

Echinocereus pectinatus, Engel., var. **robustus,** Bauer. (*G. H.* 1890, p. 513, t. 1331; *H. G.* 1890, p. 551.) G. succulent, a robust variety growing to a foot in height, with reddish spines and bright rosy fl., with the lower part of the segments white. Mexico. (Bauer, Copitz, on the Elb, Saxony.)

Epidendrum pugioniforme, Regel. (*Acta Horti Petrop.*, 1890, v. 11, p. 305.) Orchideæ. S. Allied to *E. geminiflorum*, *E. leucochilum*, &c. L. 4–6 in. long, narrow lanceolate-oblong. Fl. large, about two in a sub-sessile, terminal raceme. Sep. and pet. linear-lanceolate, at first greenish, changing to yellowish. Lip three-parted, cordate at base, at first white, afterwards yellow. Mexico. (Berge, Leipsic; St. Petersburg Botanic Garden.)

Epidendrum vitellinum, flore pleno, Rolfe. (*G. C.* 1890, viii., p. 123.) Remarkable in having "perfectly regular flowers formed of 12 segments." (G. C. Raphael, Englefield Green.)

Epiphronitis Veitchii, Rolfe. (*G. C.* 1890, v. 7, p. 799; *J. of H.* xxi., 3rd ser., p. 513, fig. 68; *Gfl.* 1890, p. 592; *W. G.* 1890, p. 345.) Orchideæ. S. An interesting hybrid raised by J. Veitch & Sons, from *Epidendrum radicans* and *Sophronitis grandiflora.*

***Episcea maculata,** Hook. f. (*B. M.*, t. 7131.) Gesneriaceæ. S. A trailing fleshy stemmed plant, with ovate green leaves, and axillary, large-bracted clusters of tubular yellow and brown flowers, which are remarkable in having one of the corolla lobes folded inwards and forming a lid-like valve to the tube. British Guiana. (Kew.)

Eremurus bucharicus, Rgl. (*Gfl.* 1890, p. 57, t. 1315, f. 1.) Liliaceæ. H. Bulb. A showy species, with triquetrous glaucous l., retrorsely serrulate-scabrous on the margin and keel, and a fl.-stem about 3 ft. high, with a long and rather lax raceme of white fl. about 1 in. in diam., the segments marked with a brownish-red median line. Buchara. (W. E. Gumbleton.)

Eucalyptus andreana, Naudin. (*R. H.* 1890, p. 346, f. 105–106.) Myrtaceæ. G. on H. H. tree, in the way of *E. amygdalina*, with lanceolate acuminate l., and globose clusters of small fl. on short peduncles, succeeded by dense clusters of globose fruits about the size of a small pea, with a depressed rim. Australia. (Vilmorin; André.)

***Eucharis bakeriana,** N. E. Br. (*G. C.* 1890, i., p. 416; *Gfl.* 1890, p. 312; *B. M.*, t. 7144; *W. G.* 1890., p. 238; *Bull Cat.* 1890, p. 7.) Amaryllideæ. S. A large flowered species, with broadly ovate leaves and flowers like those of *E. grandiflora* with the corona of *E. candida.* Colombia. (Sander & Co.)

Eucharis Stevensii, N. E. B. (*G. C.* 1890, vii., p. 641.) S. A hybrid between *E. candida* and *E. Sanderi*, raised by W. Stevens, Stone, Staffordshire.

Euonymus pulchellus foliis variegatis, Carr. (*R. H.* 1890, p. 514.) Celastraceæ. H. shr. A very dwarf, much branched form, with small variegated l. Garden variety. (Moser, Versailles.)

***Eupatorium probum,** N. E. Br. (*G. C.* 1890, vii., p. 321.) Compositæ. A useful winter-flowering greenhouse plant. It has an erect habit, hairy ovate leaves, and terminal white flower-heads. Peru. (Kew; Sir G. Macleay.)

***Faradaya splendida,** F., v. M. (*G.C.* 1890, viii., p. 300.) Verbenaceæ. S. A stout climber, with large shining green leaves, and white fragrant tubular flowers in loose terminal panicles. Australia. (Kew.)

Festuca crinum-ursi, Hort. (*W. G.* 1890, p. 208.) Gramineæ. H. ornamental grass, 2–3 in. high. No further description.

***Franseria artemisioides,** Wild. (*Dammann Cat.* 1890–91, p. 78 and 81, f. 48.) Compositæ. H. H. herbaceous plant 5–6 ft. high, with bipinnatifidly lobed l., and unisexual fl.-heads in terminal spikes, the female heads being at the basal part of the spike. Chili, Andes. (Dammann & Co.)

***Fritillaria canaliculata,** Baker. (*G. C.* 1890, v. 7, p. 288; *Gfl.* 1890, p. 395; *W. G.* 1890, p. 152 and 203. H. A pretty species resembling *F. pyrenaica*, but belonging to the section Amblirion. Fl. 3–5, campanulate, purplish. L. linear, glaucous, 3–4 in. long. February. Kurdistan. (Max Leichtlin.)

***Galanthus umbricus,** Hort. Dammann 1890, is **G. nivalis,** var. **grandior Ten.** Syn. *G. Imperati*, Bert.

Gentiana barbata, Fröl. (*G. C.* 1890, v. 8, p. 503.) Gentianaceæ. H. A slender species, 10–12 in. high, with opposite l. and erect blue flowers. Allied to *G. Pneumonanthe.* June to August. *Caucasus.* (Correvon.)

***Gladiolus decoratus,** Baker. (*G. C.* 1890, viii., p. 211; *W. G.* 1890, p. 400.) Irideæ. G. A distinct species, with leaves 2 ft. long, spikes 3 ft. high, and flowers 3 in. long by 2 in. across, bright scarlet, with three yellow oblong blotches on the lower segments. E. Africa. (Kew.)

Gladiolus Elloni, Hort. (*W. G.* 1890, p. 36.) G. A pretty species, with star-shaped white fl. tipped with purple. S. Africa. (T. Smith, Newry.)

***Gladiolus Kirkii,** Baker. (*G. C.* 1890, viii., p. 524.) G. A free flowering species allied to *G. Eckloni.* Leaves ribbed, 1½ ft. high, spike 3 ft. high, many-flowered; flowers 1½ in. long, rose-coloured. Grahamstown. (Sir John Kirk.)

***Gladiolus primulinus,** Baker. (*G. C.* 1890, viii., p. 122.) G. A robust broad-leaved species resembling *G. psittacinus*, but the flower is a uniform pale primrose yellow, without any spots or streaks. E. Africa. (Kew.)

Gladiolus turicensis, Froebel. (*Gfl.* 1890, p. 256.) H. H. A garden hybrid between *G. Saundersii superbus* and *G. gandavensis.* (Froebel & Co.)

Grammatophyllum multiflorum, Hort. (*Gard.* xxxviii., p. 93.) Orchideæ. S. Flowers greenish, with brown blotches, and borne on a stout long raceme. Habitat not published. (Sander & Co.)

Hæmanthus Lindeni, N. E. Br. (*G. C.* 1890, viii., p. 436, fig. 85; *Ill. H.* v. 37, p. 89, pl. 112; *H. G.* 1890, p. 555.) Amaryllidaceæ. S. A new species allied to *H. angolensis*, but with very much larger flowers and different leaves. Scape 1½ ft. high, with a large head of about a hundred flowers, each 2 in. in diameter, colour rosy-scarlet. Congo. (L'Horticulture Internationale.)

Hebenstreitia comosa serratifolia, Rgl. (*Gfl.* 1890, p. 191, f. 46; *B. T. O.* 1890, p. 82.) Selagineæ. G. or H. H. A very pretty perennial plant, with lanceolate, serrate l., and dense spikes of white fl. marked with a blood-red spot. South Africa. (Dammann & Co.)

Heliamphora nutans, Benth. (*B. M.*, t. 7091.) Sarraceniaceæ. S. A remarkable plant, with pitcher-like leaves as in Sarracenia, and an erect three to five-flowered scape, the flowers formed of four to six ovate acuminate white petals and a cluster of yellow stamens, suggesting Ranunculus. British Guiana. (J. Veitch & Sons.)

Helianthus Dammanni, and var. **sulphureus,** Spreng. (*Dammann Cat.* 1890–91, p. 57.) Compositæ. H. Garden hybrids, between *H. argyrophyllus* and *H. annuus.* (Dammann & Co.)

***Hemiorchis burmanica,** Kurz. (*B. M.*, t. 7120.) Scitamineæ. S. A quick growing herbaceous plant with thin rhizomes, oblong green leaves, and short erect scapes of purple and yellow flowers, each ¾ in. across. Himalayas and Burma. (Kew.)

Hippeastrum brachyandrum, Baker. (*G. C.* 1890, viii., p. 154. *Gfl.* 1890, p. 478.) Amaryllideæ. S. "It has much the largest flower of all the known species of the *Habranthus* section, and the colour is very beautiful, beginning as a pale pink, and ending as a deep blackish red at the base of the segments." S. Brazil. (A. C. Bartholomew, Reading.)

Hydrangea ramulus-coccinea, Hort. (*W. G.* 1890, pp. 246 and 407.) Saxifragaceæ. G. shr. with the young shoots and petioles dark plum-red, and the peduncles translucent red. Flowers large and tinted with rose. Garden variety. (Ellwanger & Barry, Rochester, New York.)

***Hydrangea stellata rubra plena.** (*G. C.* 1890, vol. vii., p. 165.) H. A double flowered form of *H. hortensis*; raised by Lemoine of Nancy.

***Hypericum densiflorum,** Pursh. (*G. and F.*, v. iii., p. 524, f. 67.) Hypericineæ. H. A species nearly allied to *H. prolificum*, but with narrower leaves and smaller flowers. United States.

Iris bismarckiana, Dammann. (*W. G.* 1892, pp. 355 and 353, f. 72.) Irideæ. H. A fine plant, with sword-shaped l. about 8 in long, of a bluish-green, and peduncles about 16 in. high, bearing one large fl.; the falls are ash-grey with darker veins, and a black spot at the base, the standards are sky blue with blackish veins. Lebanon. (Dammann & Co.)

Iris germanica, var. **semperflorens**, Dammann. (*W. G.* 1890, p. 355, f. 73.) H. A form described as being continually in flower, and well adapted for forcing and pot culture. Italy. (Dammann & Co.)

Iris ibirica, var. **paradoxoides**, Leichtlin. (*W. G.* 1890, p. 277; *G. C.* 1890, v. 7, p. 618.) H. A variety with a broad purple beard on the spreading yellow outer segments, the inner segments are purple with a darker network of veins. Garden variety. (Max Leichtlin.)

Iris Lortetii, Barbey. (*W. G.* 1890, p. 353.) H. Allied to *I. Sari*, about a ft. high, with linear l. 6–8 in. long, and large handsome fl.; the falls pale blue dotted with fuscous, the standards roundish, pale rosy. The above description is abridged from the original in Boissier's Flora Orientalis, none being given at the place above quoted. The true plant comes from Libanon, the garden plant is from Armenia, and may not be correctly named.

Iris macrosiphon, Torr. (*W. G.* 1890, p. 354.) H. A small species with narrow linear l. 6–15 in. long from a slender rootstock. Fl.-stem slender 1–10 in. high, with 1 or 2 bright lilac-purple or sometimes cream-coloured fl. Tube very slender, sometimes as much as 3 in. long. California.

***Iris Monspur**, Foster. (*Gard.* 1890, v. 38, p. 462, with plate). H. A hybrid between *I. Monnieri* and *I. spuria*; raised by Dr. M. Foster, and resembling the latter species. Summer. (Michael Foster.)

***Iris orchioides**, Carriere. (*Bot. Mag.*, t. 7111. *G. C.* 1889, vol. 1, p. 588.) A pretty, hardy species, allied to *I. caucasica*. Bulb ovoid. Stem 6–12 in. high, bearing 2–3 fl. sessile in axils of upper leaves. L. 5–6 lanceolate-acuminate 6–9 in. long, bright green, face channelled. Fl. bright yellow, crests orange. Central Asia. April. (Kew; Elwes.)

***Iris sindjarensis**, Boiss et Haussk. (*Bot. Mag.*, t. 7145; *G. C.* 1890, v. 7, p. 364, f. 55; *Gfl.* 1890, p. 394.) H. A distinct bulbous species, allied to *I. caucasica*, *orchioides*, and *palaestina*. It is easily distinguished by its short stems, crowded green lanceolate leaves, and lilac and purple flowers. Mesopotamia. February. (Max Leichtlin; Kew.)

Ixora armeniaca, Williams. (*Williams Cat.* 1890, p. 26.) Rubiaceæ. S. shr. of dwarf compact habit, with pale yellow fl. flushed with salmon. Garden variety. (Williams & Son.)

***Lachenalia pendula**, var. **aureliana**, Legros. (*R. H.* 1890, p. 376, with pl.; *H. G.* 1890, p. 506.) Liliaceæ. G. bulb. A robust variety with red fl. Garden variety. (Sansoldi.)

Lælia anceps, var. **hyeana**, Linden. (*L.*, v. 5, p. 71, pl. 226.) Orchideæ. S. A handsome variety with large white fl., having a stripe of light yellow on the disk of the lip and some purple veins on the side lobes. (Jules Hye-Leysen.)

Lælia anceps, var. **thomsoniana**, O'Brien. (*G. C.* 1890, viii., p. 716; *H. G.* 1890, p. 558.) S. Resembles the variety *amesiana*, but has larger flowers. (W. J. Thomson, St. Helens.)

Lælia elegans, var. **blenheimense**, Williams. (*W. O. A.*, v. 9, pl. 393.) S. A variety having the central area of the sep. pale rosy-purple, with the margins and the pet. of a deeper rosy-purple; the lip is magenta-purple with a light yellow throat. Brazil. (Duke of Marlborough.)

Lælia elegans, var. **broomeana**, O'Brien. (*G. C.* 1890, viii., p. 214; *W. O. A.*, v. 9, pl. 413.) S. A beautiful variety, sepals white and rose, petals broad, purplish-rose, lip glowing crimson. (J. Broome, Llandudno.)

Lælia juvenilis, Bleu. (*O.* 1890, p. 240, with plate.) S. A hybrid between *L. Perrinii* and *L. Pinelii*, var. *marginata*. Garden hybrid. (A. Bleu.)

Læliocattleya Hippolyta. (*J. of H.* 1890, xx., p. 302, fig. 38.) Orchideæ. Raised in the nurseries of J. Veitch & Sons, from *Cattleya Mossiæ* and *Lælia cinnabarina*.

Læliocattleya Proserpine, Rolfe. (*G. C.* 1890, viii., p. 352; *H. G.* 1890, p. 504.) A hybrid raised by J. Veitch & Sons, from *Lælia pumila*, var. *dayana* and *Cattleya velutina*.

Lastrea corusca, Bull. (*Bull Cat.* 1890, p. 7.) Filices. G. Fern with acutely triangular tripinnate fronds, of a dark shining green. Pinnæ with recurved tips, the lower ones deflexed. Pinnules narrow, elliptical or oblong, rounded at the apex, margin serrated. Japan. (W. Bull.)

***Lathraea Clandestina**, L. (*Bot. Mag.*, t. 7106.) Scrophularineæ. H. A remarkable and very handsome perennial species, differing widely from our native *L. Squamaria*, in its erect flowers, longer upper-lip of corolla, and angled seeds. Fl. violet purple. April. Europe. (Kew.)

Lepismium cavernosum, Lindb. (*Gfl.* 1890, p. 151, f. 38.) Cactaceæ. G. succulent, something in the way of *L. commune*, but with flat (not 3-angled), toothed stems, the axils of the teeth having a large cavity filled with woolly hairs. South Brazil, Paraguay. (Lindberg, Stockholm.)

Lepismium dissimile, Lindb. (*Gfl.* 1890, p. 148, f. 36–37.) G. succulent, with stout, cylindric, jointed stems, some of which are smooth, others being covered with tufts of setæ about ¼ in. long. South Brazil. (Lindberg, Stockholm.)

Lespedeza capillipes, Franch.; **L. eriocarpa,** D.C., var. **polyantha,** Franch.; **L. hirtella,** Franch.; and **L. yunnanensis,** Franch. (*R. H.* 1890, pp. 226, 227.) Leguminosæ. The above hardy per. are described at the place quoted, but it is not stated if they are in cultivation. China.

Lespedeza Delavayi, Franch. (*R. H.* 1890, p. 225, f. 70.) H. per. of bushy habit 3–6 ft. high. L. trifoliolate, leaflets elliptic obtuse, green above, silvery beneath. Fl. in a large terminal panicle, deep violet passing into purple-black. Yunnan.

Lespedeza trigonoclada, Franch. (*R. H.* 1890, p. 226.) H. per. A remarkable species with triangular stems, elongate, glabrous, coriaceous l., and terminal panicles of pale yellow or whitish fl. Gorges of Hee-chan-men, China.

Leucophyllum texanum, Benth. (*G. and F.*, iii., p. 488, fig. 63.) Scrophulariaceæ. G. A branching shrub with obovate, nearly sessile, silvery leaves, and tubular, axillary, showy, violet-purple flowers, an inch or more across. Mexico. (P. J. Berckmans, Georgia.)

Lilium alpinum, Hort. (*Gfl.* 1890, p. 478.) Liliaceæ. H. A synonym of L. parvum.

Lindneria fibrillosa, Dur. and Lubb. (*G. C.* 1890, viii., p. 240.) Liliaceæ. S. Bulb large, crowned with bristles; leaves fleshy, lanceolate, a foot long; peduncle erect, bearing a raceme of numerous greenish gamophyllous flowers 1½ in. long. A synonym of **Pseudogaltonia Pechuelii,** Kunze. Damaraland. (Brussels Botanic Garden.)

Lonicera Kesselringi, Rgl. (*Acta Horti Petrop.* 1890, v. 11, p. 310.) Caprifoliaceæ. H. shr. allied to *L. nigra*, dwarf and much branched. L. lanceolate or elliptic-lanceolate, acute, pale beneath. Fl. in pairs, axillary, red outside, white variegated with red inside, bearded in the throat of the tube, which is not gibbous at the base. Kamtschatka. (St. Petersburg Botanic Garden.)

Lonicera splendida, Boiss. (*Gfl.* 1890, p. 65, f. 13.) H. shr. belonging to the Caprifolium group, with connate oblong or obovate oblong obtuse l., and terminal heads of yellowish-white fl. about 1½ in. long. Syn. *Caprifolium splendidum*, Hort. Spain. (Transon Bros., Orleans.)

Lycaste schilleriana, Rchb. f., var. **Lehmanni,** Rgl. (*Gfl.* 1890, p. 323, t. 1321.) Orchideæ. S. A variety having the lip marked with rosy-carmine, and the pet. dotted with red on the outside. Columbia. (St. Petersburg Botanic Garden.)

Lycaste Skinneri, var. **regina,** Hort. (*G. C.* 1890, vii., p. 208.) G. Flowers rose-coloured, the lip very dark crimson. (A. Roberts, Greenhithe, Kent.)

***Lycoris squamigera,** Maxim. (*G. and F.*, iii., p. 176, fig. 32.) Amaryllideæ. H. A handsome plant which has been in cultivation several years under the name of *Amaryllis Hallii*. It has the general habit of *A. Belladonna*, flowers 4 in. long and coloured light rose. China. (Dr. Hall, Rhode Island.)

Magnolia Wiesneri, Car. (*R. H.* 1890, p. 406; *W. G.* 1890, p. 457.) Magnoliaceæ. H.? A dwarf bushy tree, glabrous in all parts, with ovate-oblong, thick, deciduous l., 6–8 in. long by 3–4 in. broad, glaucous green, and pure white fragrant fl. Japan. (Wiesener, Fontenay-aux-Roses, Seine.)

Masdevallia biflora, Rgl. (*Acta Horti Petrop.* 1890, v. 11, p. 306.) Orchideæ. S. A small-flowered species with oblanceolate-oblong l., and filiform peduncles rather shorter than the l., bearing two white fl. marked with a blackish-purple spot on the inside at the base of the lateral sep., and a purple mid-line on the upper sep. (St. Petersburg Botanic Garden.)

Masdevallia costaricensis, Rolfe. (*G. C.* 1890, viii., p. 183; *Gfl.* 1890, p. 647.) G. A small densely-tufted plant, with spathulate leaves, and three-flowered scapes, the flowers white, with yellow tails. Costa Rica. (Sander & Co.)

Masdevallia fulvescens, Rolfe. (*G.C.* 1890, viii., p. 325, fig. 65; *O.* 1890, p. 257; *H. G.* 1890, p. 504.) G. Allied to *M. infracta*, Lindl., but with more brightly coloured flowers, sepals with tails 2 in. long, light buff and brown, the upper sepal orange yellow; petals and lip very small, white. New Granada. (Horsman & Co.)

***Masdevallia guttulata**, Rolfe. (*G. C.* 1890, viii., p. 267; *H. G.* 1890, p. 503.) G. Allied to *M. tovarensis*, but the flowers are only half as large and coloured yellowish white with spots of purple. Habitat not known. (Glasnevin Botanic Garden.)

Masdevallia Lowii, Rolfe. (*G. C.* 1890, vii., p. 416, and viii., p. 269, fig. 44; *Gfl.* 1890, p. 450.) S. Allied to *M. trinema*, Rchb. f., and with the general habit of *M. Chimæra*. Flowers 3 in. across; sepals lanceolate acuminate, almost white, thickly spotted with purple; lip small, fleshy, maroon purple. Colombia (Low & Co.)

Masdevallia macrochila, Rgl. (*Acta Horti Petrop.* 1890, v. 11, p. 307.) S. Allied to *M. bella*, from which it differs in the lip. L. oblong-elliptic or oblong-lanceolate, 2–4 in. long, about 1 in. broad. Peduncle pendulous; fl. yellowish-green, densely dotted and spotted with black, lip dull orange, almost covering the limb of the lower sep. Columbia. (St. Petersburg Botanic Garden.)

Masdevallia obrieniana, Rolfe. (*G. C.* 1890, viii., p. 524.) S. A small species allied to *M. simula*, but with larger flowers and coloured yellow, spotted with maroon. Habitat not known. (R. I. Measures, Camberwell.)

Masdevallia rolfeana, Sander. (*G. C.* 1890, viii., p. 106; *G. and F.*, iii., p. 428.) G. Allied to *M. demissa*, but with larger flowers, coloured crimson-brown with yellow tails. Habitat not published. (Sander & Co.)

Masdevallia schrœderiana, Hort. (*J. of H.* 3rd. ser., p. 557, fig. 74.) No description.

Masdevallia Stella, Rolfe. (*G. C.* 1890, viii., p. 325; *O.* 1890, p. 258; *H. G.* 1890, p. 504.) S. A hybrid between *M. Estradæ* and *M. harryana*; raised by Captain Hincks, Thirsk.

Maxillaria longisepala, Rolfe. (*G.C.* 1890, v. viii., p. 94; *L.*, v. 6, p. 19, pl. 248.) Orchideæ. G. Allied to *M. pentura*, Ldl., but flowers larger and coloured purple-brown; lip greenish. Venezuela. (L'Horticulture Internationale.)

Maxillaria Mulleri, Rgl. (*Gfl.* 1890, p. 574; *Acta Horti Petrop.* 1890, v. 11, p. 307.) S. epiphyte, in the way of *M. rufescens*, with somewhat compressed 2-angled bulbs, bearing solitary leathery l. about 6 in. long. by 1 in. broad. Scape 1-flowered, with 2 inflated bracts. Sep. and pet. clear yellow, lip yellow dotted with purple. Syn. *M. squamata*, Hort. Sander. (St. Petersburg Botanic Garden.)

***Melhania melanoxylon**, Ait. (*G. C.* 1890, vii., p. 512, fig. 81.) Sterculiaceæ. S. A shrubby tree, native of St. Helena but now extinct there. It is in cultivation at Kew, where it flowered last year.

Melica papilionacea, L. (*R. H.* 1890, p. 295.) Graminea. H. H. grass of ornamental character with tufts of fine l., and narrow, slender panicles of purplish spikelets. Argentine Republic, Brazil.

Melothria punctata, Cogn. (*B. T. O.* 1890, p. 100, f. 13.) Cucurbitaceæ. Another name for **Zehneria scabra**.

Mentzelia lævicaulis, Torr. & Gr. (*W. G.* 1890, p. 400.) Loaceæ. H. annual with lanceolate, sinuate-pennatifid l., and showy large yellow fl., opening in the morning and closing at night. California.

Miltonia flavescens, Rchb. f., var. **grandiflora**, Rgl., and var. **stellatum**, Rgl. (*Gfl.* 1890, p. 433, t. 1328; *Acta Horti Petrop.* 1890, v. 11, p. 308.) Orchideæ, S. The variety **grandiflora** differs from the type by its larger and paler yellowish fl.; and var. **stellatum** (*Cyrtochilum stellatum*, Lindl.) by its rufescent bracts and white lips. Minas Geraes. (St. Petersburg Botanic Garden.)

Molinia Bertini, Carr. (*R. H.* 1890, p. 348.) Graminea. H. grass. A variegated form of *M. cærulea*. Seedling variety. (Bertin, Versailles.)

Moorea irrorata, Rolfe. (*G. C.* 1890, viii., p. 7; *Gfl.* 1890, p. 538.) Orchideæ. S. A new genus allied to *Houlletia*, from which it differs in the shape and details of the lip. The scape is 1½ ft. long and bears about a dozen flowers, each 2 in. in diameter and coloured reddish brown. Habitat not known. (Glasnevin Botanic Garden.)

***Morisia hypogaea**, Gay. (*G. C.* 1890, viii., p. 503.) Cruciferæ. H. A very interesting and beautiful alpine plant. It forms dense rosettes of shining, elegantly cut l. and sessile, bright yellow flowers. July and August. Corsica and Sardinia. (Correvon; Kew.)

Musa Seemanni, F., v. M. (*G. C.* 1890. viii., p. 182, fig. 28.) Scitamineæ. S. A native of Fiji. It has an erect inflorescence similar to *M. uranoscopus.* It is not known to be in cultivation yet.

Myosotis cintra, Sprenger. (*B.T.O.* 1890, p. 134, f. 14; *Gfl.* 1890, p. 191, f. 47.) A synonym of **M. Welwitschii,** Boiss.

Myosotis Welwitschii, Boiss. (*B. T. O.* 1890, p. 170. *Dammann Cat.* 1890–91, p. 60, v. 59, f. 29.) Boragineæ. H. annual or biennial of tufted habit, about 4 in. high, with ovate-lanceolate l., and scorpioid cymes of bright blue fl. with a yellowish-white eye. Syn. *M. cintra.* Portugal. (Dammann & Co.)

Myrica rubra, S. and Z. (*R. H.* 1890, p. 450.) Myricaceæ. H. The corrected name for the plant known as *M. nagi.*

Narcissus monophyllus × N. calathinus, Foster. (*G. C.* 1890, v. 7, p. 388.) Amaryllideae. H. A very remarkable hybrid, raised by Dr. M. Foster, and resembling *N. monophyllus.* Fl. white. March. (Michael Foster.)

Narcissus syriacus, Boiss. (*W. G.* 1890, p. 362, f. 80.) H. A handsome species, with large white fragrant fl. in close umbels. (Dammann & Co.)

Nepenthes Burkei, var. **excellens,** Masters. (*J. of H.* xxi., 3rd ser., p. 161, fig. 21.) Nepenthaceæ. S. Pitchers larger and more richly coloured than in the type. (J. Veitch & Sons.)

Nepenthes Burkei, var. **prolifica,** Masters. (*G. C.* 1890, viii., p. 184.) S. Leaves narrow and pitchers smaller than in the type. (J. Veitch & Sons.)

Nepenthes obrieniana, Lind. & Rod. (*Ill. H.* v. 37, p. 109, pl. 116.) S. A distinct looking Pitcher-plant, with long, narrow pitchers, the basal part green and slightly ventricose, the upper half cylindric and reddish, the mouth with a green rim. Borneo.

Nepenthes stenophylla, Mast. (*G. C.* 1890, viii., p. 240; *Gfl.* 1890, p. 647.) S. Allied to *N. Curtisii.* Leaves narrow; pitchers 6 to 7 in. long by 1½ in. broad, green, with numerous longitudinal dark reddish purple spots, rim narrow, lid small. Borneo. (J. Veitch & Sons.)

***Nephrolepis cordata,** var. **compacta,** Veitch. (*Veitch Cat.* 1890, p. 12.) Filices. S. An elegant fern with arching fronds 15–24 in. long, furnished from the base with compactly placed oblong toothed pinnules, less than an inch long, deep shining green with a darker midnerve. The lowest pinnules are cordate and barren. (J. Veitch & Sons.)

Nerine pumila, Leichtlin. (*B. T. O.* 1890, p. 73.) Amaryllideæ. G. A very beautiful plant, very similar to *N. curvifolia,* with an umbel of 16–18 brilliant scarlet fl., with a golden sheen. The l. appear after the fl., and are about 10 in. long, channelled, glaucous, incurved and spreading on the ground. (Max Leichtlin.)

Nerine rosea, var. **crispa,** Dammann. (*W. G.* 1890, p. 362, f. 81.) G. A hybrid between *N. undulata* and *N. flexuosa.* Garden hybrid. (Dammann & Co.)

Nidularium princeps, Morr., var. **magnificum,** Kitt. (*Gfl.* 1890, p. 289, t. 1223.) Bromeliaceæ. S. per. An ornamental Bromeliad, differing from the type in having the lower leaves shorter and broader, and of a dark vinous-purple, the upper elongate, narrower, green with bright rosy tips, lepidote beneath. Garden variety obtained by bud variation of the type. (Kittel, Eckersdorf, Silesia.)

Odontoglossum Alexandræ, var. **Outramii,** Williams. (*W. O. A.* v. 9, pl. 403.) Orchideæ. S. A handsomely spotted form, with a flush of rosy-purple along the middle of the sep. Columbia. (Williams & Son.)

Odontoglossum crispum, Lindl., var. **mundyanum,** Sander. (*R.* 2nd ser. v. 1, p. 11, t. 5.) S. A handsome form, marked with very large blotches of magenta-purple, and having the back of the sep. and pet. flushed with purple. (Sander & Co.)

Odontoglossum crispum, var. **plumatum,** Williams. (*W. O. A.* v. 9, pl. 414.) S. A pretty variety having the sep. and pet. flushed with a soft rosy-purple tint and freely spotted with cinnamon-brown. Columbia. (Williams & Son.)

Odontoglossum cristatum, Lindl., var. **Lehmanni,** Rgl. (*Gfl.* 1890, p. 58, t. 1315, f. 2.) S. A variety with oblong-lanceolate acute sep., elliptic-lanceolate acute pet., and an obovate-oblong lip, obtusely rounded and with the edges turned up so as to form a short cucullate point at the apex, the crest formed of two keels with three or four tubercles on each side at their base. The colour is yellow, marked with brown. Popayan. (St. Petersburg Botanic Garden.)

Odontoglossum leroyanum, L. Castle. (*Gard.* xxxvii., p. 550.) S. A hybrid between *O. crispum* and *O. luteo-purpureum*; raised by M. Leroy, gardener to Baron E. de Rothschild, Gretz.

Odontoglossum schlesingerianum, Linden. (*L.* v. 5, p. 99, pl. 240.) S. A form of *O. crispum*, with handsomely spotted fl. (L'Horticulture Internationale.)

Odontoglossum wattianum, Rolfe. (*G. C.* 1890, vii., p. 354. *R.* 2nd ser. v. 1, p. 19, t. 9; *O.* 1890, p. 162; *Garden* 1890, pl. 751.) S. Supposed to be a natural hybrid between *O. luteo-purpureum* and *O. lindleyanum*. The sep. and pet. resemble in form and colour those of *O. luteo-purpureum*, and the lip is 1½ in. long, the margin fringed, the colour white with large blotches of claret red. Habitat not published. (Sander & Co.)

Odontoglossum Youngi, Gower. (*Gard.* xxxvii., p. 84; *W. O. A.* pl. 406.) S. Allied to *O. Œrstedii*, flowers yellow, heavily spotted with brown. Habitat not published. (R. Young, Linnet Lane, Liverpool.)

Oncidium larkinianum, Gower. (*Gard.* xxxviii., p. 247; *W. O. A.*, t. 405.) G. Allied to *O. Forbesii*. Scape branched, many flowered; flowers coloured rich chocolate brown and bright yellow. Organ Mts. (J. Larkin, Highbury New Park.)

Oncidium leopoldianam, Rolfe. (*G.C.* 1890, viii., p. 556; *H. G.* 1890, p. 556.) S. A species of the *Cyrtochilum* section. Peduncles many flowered; flowers 1½ in. across, sepals and petals white with a purple disc, lip violet purple. "Some part of the Andes." (L'Horticulture Internationale.)

***Onosma albo-roseum,** Stapf. and Leichtl. (*G. and F.*, v. 3, p. 523.) Boraginaceæ. H. per. A fine species, with hoary greyish leaves, and white fl., which after a few days change to deep rose. Asia Minor. (Max Leichtlin.)

Oxalis binervis, Rgl. (*Acta Horti Petrop.* 1890, v. 11, p. 312.) Geraniaceæ. G. A bulbous species. L. with 3 deeply bifid leaflets, the lanceolate-oblong lobes subfalcate and two-nerved, dark purple beneath. Fl. 3 to 7 in an umbel, white. (St. Petersburg Botanic Garden.)

***Pæonia Bakeri,** Lynch. (*Journal of the Royal Horticultural Society*, vol. 12, p. 441, f. 32.) Ranunculaceæ. H. per. A distinct looking plant about 2 ft. high, with a stout, pilose, reddish stem, bearing about 6 biternately divided l., with broadly ovate acute leaflets, the terminal one 3-lobed, hairy and glaucous beneath. Fl. about 4½ in. in diam. deep rose. Syn. *P. peregrina*, var. *byzantina*, Hort. Barr. (Barr & Son; Cambridge Botanic Garden.)

***Papaver californicum,** A. Gr. (*W. G.* 1890, p. 403.) Papaveraceæ. H. An ornamental poppy over a foot in height, with fl. about 2–2½ in. in diam., of a clear orange, with a yellow centre. California.

***Papaver rupifragum,** Boiss. et Reut., var. **atlanticum,** Ball. (*Bot. Mag.*, t. 7107; *Gfl.* 1890, p. 394.) H. A showy perennial poppy. Stems many, 1–2 ft. high, hairy, l. 6–8 in. long, oblanceolate, obtuse, pinnate, bright green. Buds drooping. Fl. 2–3 in. in diam., orange-red or scarlet. Morocco. April. (Kew.)

Pedicularis megalantha, Don. (*B. M.* tab. 7132.) Scrophularineæ. H. One of the most beautiful of this rarely cultivated genus. Stems hairy, 1–2 ft. high, l. 2–10 in. long, twice pinnatifid, lower bracts longer than the flowers, fl. rose purple. Himalayas. (G. F. Wilson.)

***Pelargonium saxifragoides,** N. E. Br. (*G. C.* 1890, viii., p. 154; *Gfl.* 1890, p. 477.) Geraniaceæ. G. Belongs to the same group as the "ivy-leaved geranium." Dwarf, compact, with bright green fleshy saxifraga-like leaves and small pink and purple flowers. S. Africa. (Kew.)

***Peliosanthes albida,** Hook. f. (*B. M.*, t. 7110.) Hæmodoraceæ. S. A dwarf plant with a tuft of elegant plicate green leaves, and an erect spicate inflorescence, bearing numerous small white flowers. Malay Peninsula. (Kew.)

***Pentstemon puniceus,** Gray. (*Gard.* v. 38, p. 147.) Scrophularineæ. H. A showy species 1–6 feet high, with thick oblong glaucous l., and brilliant scarlet funnel-shaped flowers, 1½ in. long. June. Arizona. (W. Thompson.)

Phacelia orcuttiana, Gray. (*W. G.* 1890, p. 403.) Hydrophylleæ. H. A viscid annual, with pinnatifid l. and white fl. having a yellow centre. California.

Phaius Cooksoni, Rolfe. (*G. C.* 1890, vii., p. 388, fig. 57; *J. of H.* xx. 3rd ser., p. 446, fig. 65.) Orchideæ. S. A beautiful hybrid obtained from *P. tuberculosus* and *P. Wallichii.* (N. C. Cookson, Wylam-on-Tyne.)

Phalænopsis Cynthia, Rolfe. (*G. C.* 1890, vii., pp. 132 and 227.) Orchideæ. S. A supposed natural hybrid between *P. schilleriana* and *P. Aphrodite.* It scarcely differs from *P. leucorrhoda.* (Low & Co.)

Phalænopsis esmeralda, Rchb. f., var. **candidula,** Rolfe. (*L.* v. 6, p. 49, pl. 263.) S. A pretty variety with white fl., having the lip streaked and flushed with rosy purple. Cambodia. (L'Horticulture Internationale.)

Phalænopsis Micholitzi, Hort. (*Garden,* xxxviii., p. 532.) S. "Something in the way of *P. tetraspis,* but it comes from the Philippines and not from the Andamans. It has light green leaves and short spikes of creamy white flowers." (Sander & Co.)

Pharbitis triloba, Miq. (*W. G.* 1890, p. 161.) Convolvulaceæ. S. A synonym of **Ipomœa hederacea,** Jacq.

Pholidota assamica, Hort. Sander. (*Gfl.* 1890, p. 607.) Orchideæ. S. epiphyte, similar to *P. imbricata,* but differs by its nearly globose bulbs. (Sander & Co.; St. Petersburg Botanic Garden.)

Phormium alpinum, P. flaccidum, P. Hursthonsii, and **P. robustum,** Hort. (*W. G.* 1890, p. 448.) Liliaceæ. S. per. No descriptions beyond the statement that *P. Hursthonsii* has long panicles of purple fl. New Caledonia.

Picea excelsa, var. **reflexa,** Carr. (*R. H.* 1890, p. 259 f. 73; *Gfl.* 1890, p. 538.) Coniferæ. H. shr. A form with pendulous branches. Garden variety. (Croux, Aulnay.)

Pilocereus columna-trajani, Karw. (*R. H.* 1890, p. 130, f. 40.) Cactaceæ. A synonym of *T. columna.* Lem.

Pinus latifolia, Sargent, (*G. and F.* 1889, v. 2, p. 496, f. 135.) Coniferæ. H. tree. A species allied to *P. ponderosa,* with very long l. and persistent sheaths. Santa Rita Mountains, Arizona.

Pithecoctenium clematideum, Griseb. (*B. T. O.* 1890, p. 24, t. 2.) Bignoniaceæ. G. An ornamental climber, with slender stems, l. ending in a tendril with two ovate-acuminate leaflets, or sometimes three leaflets, and then without a tendril, and large terminal racemes of showy, trumpet-shaped white fl. with a yellow throat. Argentine Republic. Syn. *Anemopægma clematideum,* Griseb. (R. H. 1890, p. 294.)

***Polygonum lanigerum.** R. Br. (*Gfl.* 1890, p. 224, f. 52; *Dammann Cat.* 1890–91, p. 63.) Polygonaceæ. H. H. herbaceous per. 6–10 ft. high, with long lanceolate l., wavy on the margin, covered with a silvery tomentum; fl. in clustered spikes, carnation-red. Natal. (Dammann & Co.)

Populus Viadri, Rudiger. (*Gfl.* 1890, p. 447.) Salicineæ. H. tree something in the way of *P. nigra,* but branching lower down the trunk, the branches more curved and more branched, the l. more cordate and paler beneath, and the tree more fertile. Germany.

***Prestoea Carderi,** Hook. f. (*B. M.,* t. 7108; *Gfl.* 1890, p. 424.) Palmæ. S. This is the Palm known in gardens as *Geonoma Carderi.*

Primulina sinensis, Hook. f. (*Gfl.* 1890, p. 478; *B. M.,* t. 7117.) Gesneracea, an error for **P. tabacum.**

Prunus allegheniensis, Porter. (*G. and F.,* vol. III., p. 429, f. 53.) Rosaceæ. H. A deciduous shrub or small tree nearly allied to the European *P. insititia.* United States.

Prunus baldschuanica, Rgl. (*Gfl.* 1890, p. 613; *Acta Horti Petrop.* 1890, v. 11, p. 314.) H. shr. or dwarf tree, in the way of *P. divaricata,* but with obovate-elliptic, coarsely and doubly serrate l., an ovate-cylindric calyx-tube, and red fl. Province of Baldschuan, Buchara. (St. Petersburg Botanic Gardens.)

Prunus japonica, var. **sphærica,** Carr. (*R. H.* 1890, p. 468, fig. 136, and plate.) H. tree. A variety with globose fr. of a dark vinous red. Garden variety.

Prunus juliana, var. **pendula,** Späth. (*Späth Cat.* 1889–90, p. 3.) H. A form with pendulous branches. Garden variety. (Späth.)

Prunus laurocerasus, var. **schipkaensis,** Späth. (*Späth Cat.* 1889–90, p. 2.) H. An especially hardy form, from the northern slopes of the Balkan Mountains. (Späth.)

Prunus subcordata, Benth. (*Späth Cat.* 1889–90, p. 3.) H. shr. with roundish, finely serrated l., slightly cordate at the base. Fl. as in the ordinary plum. California. (Späth.)

Psidium passeanum, André. (*R. H.* 1890, p. 233, f. 71.) Myrtaceæ. S. Shr. 3–6 ft. high, with slender round stems, opposite, ovate-lanceolate, acuminate l. on short petioles, and axillary white fl. The fr. is pear-shaped, about as large as a plum, pale green or yellowish, eatable. (Commandant Passé, Cannes.)

Pteris ensiformis, Burm., var. **Victoriæ,** Baker. (*G. C.* 1890, vii., p. 576.) Filices. A pretty stove fern, allied to *P. cretica*, but with more numerous and elegant fertile fronds, prettily marbled with white. Malaya. (W. Bull.)

***Pyrus thianschanica,** Rupr. (*Acta Horti Petrop.* 1890, v. 11, p. 312, with fig.) Rosaceæ. H. shr., or small tree, very similar to *P. aucuparia*, but with the buds tomentose and the young foliage villose. Central Asia. (St. Petersburg Botanic Garden.)

***Ranunculus Buchanani,** Hk. f. (*Dammann Cat.* 1890–91, p. 80.) Ranunculaceæ. H. Alpine plant. A dwarf and handsome species, with the l. two or three times trifidly divided, and a fl.-stem 6–12 in. high, bearing one pure white fl., 2 in. or more in diam. New Zealand, at 5,000 to 7,000 ft. elevation. (Dammann & Co.)

***Rehmannia rupestris,** Hemsl. (*G. and F.*, v. 3, p. 418.) Scrophularineæ. H. H. An interesting species 1–1½ ft. high. The central stem erect, the lateral ones all drooping; l. oval, fleshy, toothed, and covered with long silky hairs. Fl. tubular, white tinged with rose. July. W. China. (Kew.)

Retinospora obtusa, var. **troubetzkoiana,** Hort. (*G. C.* 1890, v. 7, p. 108; *H. G.* 1890, p. 232.) Coniferæ. H. shr. Garden variety. (Fratelli Rovelli.)

Rhipsalis Regnellii, Lindb. (*Gfl.* 1890, p. 118, f. 29, and 31–33.) Cactaceæ. G. succulent, very similar to *R. Houlletii*, with broad, flat, coarsely toothed branches, and small white fl. South Brazil. (Lindberg, Stockholm.)

***Rhododendron scabrifolium,** Franchet. (*G. C.* 1890, vii., p. 450.) Ericaceæ. G. An erect unbranched plant with scabrid, hairy, ovate acuminate leaves 2½ in. long, and a compact head of flowers each 1½ in. across, white, tinted with rose. Yunnan. (Kew.)

Rhodostachys pitcairniæfolia, Bth., var. **kirchhoffiana,** Wittm. (*Gfl.* 1890, p. 345, t. 1325.) Bromeliaceæ. S. A pretty Bromeliad with numerous narrow, channelled, green l., the inner ones reddish at their base inside, surrounding a dense sessile head of blue fl. It differs from the type in being smaller, more slender, and with the bracts smooth within. Chili. (Count Kirchhoff, Baden.)

***Rhopaloblaste hexandra,** Scheff. (*W. G.* 1890, p. 399; *Bull Cat.* 1890, p. 7, and 6 with fig.) Palmæ. S. Palm with unarmed slender stem, and regularly pinnate l., having small linear acute leaflets. This is the same as *Bentinckia ceramica*. (W. Bull.)

Richardia elliottiana, Hort. (*W. G.* 1890, p. 277.) Aroideæ. G. Similar to *R. æthiopica*, but with large yellow spathes and the leaves spotted with white. (Knight, Farnborough.)

Robinia decaisneana, var. **rubra,** André. (*R. H.* 1890, p. 275; *W. G.* 1890, p. 291.) Leguminosæ. H. shr. or tree. A seedling form with rose-coloured fl. Garden variety. (Croux, Aulnay.)

Rodriguezia Fuerstenbergii, Kranzlin. (*G. C.* 1890, viii., p. 746; *H. G.* 1890, p. 558.) Orchideæ. S. Allied to *R. leeana*. Pseudobulbs and leaves small; raceme a foot long, 3-fld.; flowers 2 in. long, and more than 1 in. broad, sepals rose-coloured, petals and lip white, blotched with yellow. Habitat not published. (Count Fuerstenberg.)

Rosa rugosa, var. **fimbriata,** Car. (*R. H.* 1890, p. 427, f. 131; *W. G.* 1890, p. 450.) Rosaceæ. Garden hybrid. (Morlet, Avon, Seine-et-Marne.)

Roscoea purpurea, var. **sikkimensis,** Elwes. (*G. C.* 1890, viii., p. 221.) Scitamineæ. S. Supposed to differ from the type in the stem and roots and also in the shade of purple of the flowers.

Saccolabium bivittatum, Rgl. (*Gfl.* 1890, p. 607; *Acta Horti Petrop.* 1890, v. 11, p. 309.) Orchideæ. S. epiphyte, allied to *S. paniculatum*, with strap-shaped leathery l., and a lax drooping spike of small fl., sep. and pet. yellowish marked with two purple-brown stripes, lip white, nearly as long as the sep. East Indies. (St. Petersburg Botanic Garden, received as *Aerides Picotianum*.)

Salvia flocculosa, Benth., var. **verticillata pauciflora,** Regel. (*B. T. O.* 1890, p. 268.) Labiatæ. G. A shrubby plant with bright green lanceolate-ovate l., thin and regulose. Fl. in terminal spikes, of rich red colour with two white spots on the upper lip. Andes of Quito. (Dammann & Co.)

Salvia phœnicea, Benth. (*B. T. O.* 1890, p. 267.) G. or S. A pretty species, with ovate or oblong-ovate, rather finely toothed l., 1–2 in. long, and terminal spikes of magenta-carmine fl. Ecuador. Andes of Quito. (Dammann & Co.)

Salvia prunelloides, var. **purpurea,** Haage & Schm. (*Gfl.* 1890, p. 564; *H. G.* 1890, p. 484, with fig.) H. annual. A variety with purple-red fl. (Haage & Schmidt.)

Sambucus Gautschii, Wettstein. (*W. G.* 1890, pp. 292, 371; *Oesterr. Bot. Zeitschrift,* 1890, v. 40, p. 230.) Caprifoliaceæ. H. tree. Seems to be a mere form of **S. Ebulus.** India. (Vienna Botanic Garden.)

Sarcopodium godseffianum, Sander. (*G. C.* 1890, vii., p. 800; *Gards. Mag.* 1890 (II.), p. 540, with fig.) Orchideæ. S. Like *S. Dearei,* but the flowers are a little larger, being 2 inches across; sepals and petals coloured yellow and brown, the cordate, versatile lip, creamy white with purple spots. Habitat not published. (Sander & Co.)

***Saxifraga Boydi,** Dewar. (*Gard.* v. 38, p. 10, with plate.) Saxifrageae. A charming little hybrid, raised by Mr. Boyd, between *S. Burseriana* and *S. aretioides.* Fl. several on a stem, large golden yellow. Rosettes, leaves and general habit of *S. Burseriana.* Hardy. March. (Boyd.)

***Saxifraga Engleri,** Della Torre. (*Gfl.* 1890, p. 649.) H. per. A hybrid between *S. aizoon* and *S. cuneifolia.*

***Saxifraga montanovensis,** Hort. (*Gfl.* 1890, p. 649.) H. per. Probably a variety of *S. cotyledon,* with white fl., the calyx and stamens being red.

Scaphosepalum antenniferum, Rolfe. (*G. C.* 1890, vii., p. 709.) Orchideæ. G. Leaves elliptical, 3–8 in. long; scape 18 in. long. Flowers greenish yellow, lined with brown. Allied to *Masdevallia pulvinaris,* Rchb. f. Habitat not published. (Shuttleworth & Co.)

***Scilla anti-taurica,** Hort. (*G. and F.* v. 3, p. 169.) Liliaceæ. H. An early flowering, robust, many flowered form of *S. sibirica.* February. Anti-Taurus. (Whittall, Smyrna.)

Scilla hyacinthoides, L., var. **stricta,** Regel. (*Acta Horti Petrop.* v. 11, 302.) H. A form having solitary bulbs, and erect pedicles to the fl. Palestine. (Dammann & Co.)

Selenipedium weidlichianum, Hort., Sand. (*G. C.* 1890, viii., p. 702.) Orchideæ. S. A hybrid between *S. Hartwegii* and *S. Schlimi,* scarcely differs from *S. Sedeni.* Raised by Sander & Co.

Senecio Palmeri, A. Gr. (*W. G.* 1890, p. 120, f. 24.) Compositæ. G. per., or may be treated as a H. annual, likely to become a very useful plant for bedding purposes. It is a branching plant 1–2 ft. high, densely clothed with a white felt; the l. are oblong-lanceolate, narrowed into a rather long stalk, and slightly toothed. The fl. heads are few in a pedunculate corymb, with yellow rays, and about an inch in diam. Guadeloupe Island, Lower California.

Sequoia sempervirens, var. **variegata,** Carr. (*R. H.* 1890, p. 330.) Coniferæ. H. tree. A form with very glaucous and slightly variegated foliage. Garden variety. (Croux et fils, Aulnay.)

***Sicana spherica,** Hook. f. (*B. M.*, t. 7109.) Cucurbitaceæ. S. A vigorous climber, with stout, lobed leaves, and fleshy, yellowish, campanulate flowers, 4 in. across. Fruit globose, as large as an orange. Jamaica. (Kew.)

Sobralia Lowii, Rolfe. (*G. C.* 1890, viii., p. 378; *H. G.* 1890, p. 553.) Orchideæ. S. Stems from 12 in. to 18 in. high; flowers uniform bright purple. It is allied to *S. sessilis.* New Granada. (Low & Co.)

Sobralia Sanderæ, Rolfe. (*G. C.* 1890, viii., p. 494; *H. G.* 1890, p. 555.) S. Allied to *S. leucoxantha,* but the flowers are larger and without the orange markings in the throat. Central America. (Sander & Co.)

Sobralia Wilsoni, Rolfe. (*G. C.* 1890, viii., p. 378; *H. G.* 1890, p. 554.) S. A near ally of *S. Warscewiczii.* Flowers large, white suffused with rose, and blotched with yellow on the lip. Central America. (A. Wilson, Sheffield.)

***Solanum dammannianum,** Regel. (*Acta Horti Petrop.* 1890, v. 11, p. 311; *Dammann Cat.* 1890–91, p. 80–81, f. 2.) Solanaceæ. S. An ornamental, robust plant, growing to 8 or 9 ft. high. The stems are covered with stipitate stellately-branched hairs; the large cordate-ovate l. have wavy, sinuate borders, and are tomentose on both sides. Fl. in clusters, large, dark blue, succeeded by yellow berries. (Dammann & Co.)

Solanum Duchartrei, Heckel. (*W. G.* 1890, p. 367.) S. shr. growing to about 20 in. high, prickly in all parts, with sinuately lobed l. and purple fl., hairy on the outside. W. Tropical Africa.

*__Sonerila orientalis,__ Bull, and varieties **guttulata, picta,** and **punctata,** Bull. (*Bull Cat.* 1890, p. 8, and p. 3 with fig.) Melastomaceæ. S. per. Beautiful, free flowering melastomads, producing a profusion of bright rosy or purple fl. with yellow anthers. The l. are broadly ovate acute, with a cordate base, and in the different varieties are of a crimson maroon, with or without a feathered, whitish, central band, or dotted with white on a light or dark green ground. Arracan Hills. (W. Bull.)

Sophrocattleya Calypso, Rolfe. (*G.C.* 1890, viii., p. 588; *H. G.* 1890, p. 556.) Orchideæ. S. A hybrid between *Sophronitis grandiflora* and *Cattleya Loddigesii,* var. *Harrisonæ;* raised by J. Veitch & Sons.

Spiræa opulifolia, L., var. **heterophylla foliis aureis marginalis,** Wolf. (*Gfl.* 1890, p. 9, f. 2–3.) Rosaceæ. H. shr. An ornamental variety with irregularly lobed l. variegated with yellow. Garden variety. (Imperial Forest Institute, St. Petersburg.)

Spiranthes albescens, Rodrig. (*Gfl.* 1890, p. 607.) Orchideæ. S. An older name for *S. leucosticta,* Rchb. f.

Stanhopea spindleriana, Kranzlin. (*Gfl.* 1890, p. 625, t. 1335; *H. G.* 1890, p. 552.) Orchideæ. S. A garden hybrid between *S. oculata* and *S. tigrina.* (Raised by Mr. Spindler, Spindlersfeld.)

Stemodia durantifolia, Swartz. (*Dammann Cat.* 1890–91, p. 80.) Scrophulariaceæ. G. or H. H. annual, branching from the base, with opposite, sessile, lanceolate, toothed l., and terminal spikes of bluish-purple fl. Tropical America. (Dammann & Co.)

Stevia odorata, Damm. (*Dammann Cat.* 1890–91, p. 80 and 83, f. 53.) Compositæ. G. per. A free flowering species about 16 in. high, with narrow lanceolate acuminate l., and odorous white fl. in terminal corymbose cymes. (Dammann & Co.)

*__Streptocarpus Wendlandii,__ Sprenger. (*Dammann Cat.* 1890–91, p. 80.) Gesneraceæ. S. or G. per. A fine species with l. 2–3 ft. long, by 8–12 in. broad. Fl. in a tall panicle, somewhat like those of *S. Dunnii* in size and form, but of a clear blue colour. Natal. (Dammann & Co.)

*__Syringa Bretschneideri.__ (*W. G.* 1890, p. 369.) Oleaceæ. This is stated to be synonymous with *S. villosa,* Vahl., and *S. emodi,* var. *rosea,* Max Cornu, noted in the Kew Bulletin for 1889, p. 108.

*__Syringa pekinensis.__ (*G. and F.*, v. III., p. 165, f. 30.) H. A deciduous shrub with white flowers; nearly allied to *S. amurensis.* China.

*__Thalictrum Delavayii,__ Franchet. (*B. M.*, t. 7152; *G. C.* 1890, v. 8, p. 124, fig. 19.) Ranunculaceæ. H. herbaceous perennial of neat graceful habit. Stems 2–3 ft. high. Radical l. long petioled, ternately decompound, 10–12 in. broad, leaflets obtusely 3–5 lobed, base cordate, fl. pale purple, in lax panicles. Sepals ½ in. long, obtuse, elliptic ovate. A very handsome species allied to *T. Chelidonii,* June. Yunnan. (Kew.)

Thujopsis borealis, var. **nidifera,** Hort. (*G. C.* 1890, v. 7, p. 108; *H. G.* 1890, p. 232.) Coniferæ. H. A seedling variety with plume-like branchlets; raised by Rovelli, Balanza, Italy.

Thuya occidentalis, var. **Spathii,** P. Smith. (*Gfl.* 1890, p. 226, f. 54.) Coniferæ. H. shr. or tree. A variety with thread-shaped young shoots, which become regularly feathered the second year. Seedling variety. (P. Smith & Co., Bergedorf.)

Tilia argentea, var. **orbicularis,** Car. (*R. H.* 1890, p. 397.) Tiliaceæ. H. tree. A form with pendant branches, and thick, coriaceous, orbicular or rhomboidal l., cordate at the base, silvery beneath. Seedling variety. (Simon-Louis, Plantieres-les-Metz.)

*__Trachycarpus khasyanus,__ Wendl. (*B. M.* 7128.) Palmæ. S. A noble greenhouse palm, of which there are two very tall specimens in the Temperate House at Kew, one of which flowered lately. This species has been in cultivation many years under the names *T. Griffithii, Chamærops Griffithii* and *C. Martiana.* Eastern Bengal and Burma. (Kew.)

Trichopilia punctata, Rolfe. (*G. C.* 1890, vii., p. 227; *O.* 1890, p. 65.) Orchideæ. G. "Remarkable in having both sepals and petals studded with numerous reddish purple spots." Costa Rica. (Sander & Co.)

*__Trillium sessile,__ var. **californicum.** (*G. and F.*, 1890, p. 321, f. 44.) Liliaceæ. H. A robust, large flowered form from California.

*__Tulipa ciliatula,__ Baker. (*G. C.* 1890, v. 7, p. 640; *Gfl.* 1890, p. 426.) Liliaceæ. H. Nearly allied to *T. undulatifolia,* differing chiefly from that species in the shorter obtuse perianth segments, and from *T. præcox* by its sub-glabrous bulb scales. Fl. bright crimson. Asia Minor. (Kew; Barr & Son; T. S. Ware.)

***Viburnum pauciflorum,** Pyl. (*G. and F.*, vol. iii., p. 4, f. 1.) Caprifoliaceæ. A deciduous shrub which may be described as a dwarf *V. Opulus*. Eastern United States.)

Viburnum stellatum, Hemsley? (*Späth Cat.*, 1889–90, p. 3.) H. shr. with thick, rugose, strongly veined, oblong-ovate l., about 6 in. long and 3½ in. broad. N. America. (Späth.)

Vitis acuminata, Carr. (*R. H.* 1890, p. 183; *W. G.* 1890, p. 298.) Ampelideæ. H. Vine with narrow ovate, entire l., rounded or slightly cordate at the base, gradually attenuate to a sharp point, scarcely toothed on the margin, glabrous above, with a very short glaucous-white pubescence beneath. Fr. large, black, in long, narrow, bunches. Eastern Asia.

Vitis Cognetiæ, Planch. (*R. H.* 1890, pp. 23, 49.) H. vine. Said to differ from *V. labrusca* by its interrupted tendrils, but the difference does not seem to be very apparent. Japan.

Vitis rutilans, Carr. (*R. H.* 1890, p. 444, with pl.) H. vine, with the stems and petioles densely clothed with setæ of a brilliant dark red colour, l. broadly cordate, acute, serrate, glaucous beneath. Eastern Asia.

Vriesea gravisiana, Closon. (*R. H. B.* 1890, p. 49, with pl.; *W. G.* 1890, p. 154; *Gfl.* 1890, p. 494, f. 81; *H. G.* 1890, p. 503.) Bromeliaceæ. S. A garden hybrid between *V. psittacina*, var. *morreniana*, and *V. Barilleti*. (Jacob-Makoy; Botanic Garden, Liége.)

Vriesea kitteliana, Wittm. (*Gfl.* 1890, p. 326, f. 62, 63.) S. A garden hybrid between *V. Barilleti* and *V. Saundersii*. (Kittel, Ekersdorf, Silesia.)

Vriesia leodiense, Mackoy. (*W. G.* 1890, p. 154.) S. A hybrid between *V. psittacina*, var. *morreniana*, and *V. Barilleti*. Garden hybrid. (Jacob-Makoy.)

Vriesea weyringeriana, Wittm. (*Gfl.* 1890, p. 7, f. 1.) S. A hybrid between *V. Barilleti* and *V. scalaris*. Garden hybrid. (Weyringer, Vienna.)

Waluewa puchella, Rgl. (*Acta Horti. Petrop.* 1890, v. 11, p. 309.) Orchideæ. S. A new genus allied to *Gomeza*. A small tufted plant, with compressed, oblong or sub-linear bulbs 2–2½ in. long, bearing one lanceolate acute l. 2½ in. long. Racemes basal, 6–8 flowered, recurved. Fl. about ½ an inch long, yellowish, with a purple band on the pet., and purple spots on the lip. Brazil. (St. Petersburg Botanic Garden.)

***Xylobium Colleyi,** Rolfe. (*G. C.* 1890, vii., p. 288.) Orchideæ. S. Pseudobulbs round; leaves large, Stanhopea-like. Flowers on short scapes, reddish brown with purple spots, with an odour like that of cucumber. Syn. *Maxillaria Colleyi*, Ldl. Trinidad. (Kew.)

Zinigber Darceyi, Veitch. (*Veitch Cat.* 1890, p. 13; *W. G.* 1890, p. 398; *Gard.*, v. 38, p. 43.) Scitamineæ. S. foliage plant of robust habit, growing to 2 or 3 ft. high, with lanceolate l. 6–8 in. long by 2–2½ in. broad, of a bright green, with a broad cream-white margin, and oblique stripes of the same colour. Introduced from the Botanic Garden, Sydney. (J. Veitch & Sons.)

Zygopetalum crinito-maxillare, Hort. (*Gard.* xxxviii., p. 43.) Orchideæ. S. A hybrid whose parentage is indicated by the specific name. (Lord Rothschild, Tring.)

Zygopetalum jorisianum, Rolfe. (*G. C.* 1890, vii., p. 704; *L.* v., 5, p. 93, pl. 237.) G. Has the habit of *Z. intermedium*; lip three lobed and beautifully fimbriate. Venezuela. (L'Horticulture Internationale.)

Zygopetalum Whitei, Rolfe. (*G. C.* 1890, vii., p. 354; *O.* 1890, p. 194.) S. Leaves about a foot long; scape short; flowers 2½ in. in diameter, creamy white, lip partly yellow. New Granada. (R. B. White, Arddarrock.)

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX III.—1891.

BOTANICAL DEPARTMENTS, AT HOME AND ABROAD.

In previous numbers of the *Kew Bulletin* (May 1889 and August 1890) there have been published lists of the staffs of the Royal Gardens, Kew, and of Botanical Departments and Establishments at home, and in India, and the Colonies, in correspondence with Kew. These lists have proved of considerable value in affording a convenient means for placing on record the official titles and designations of the officers concerned, and in giving from time to time notification of the changes that have taken place in the several appointments. In the present list an enumeration is given of the officers that have been selected to carry out the recently organised botanical survey of India, with the districts allotted to each one. A fuller list is also given of officers in charge of gardens in Native States. The organisation of the Botanical Department of the Leeward Islands brings into one group the several botanical stations existing in those islands.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & CO., 12, HANOVER STREET, EDINBURGH, and
90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.

Price Twopence.

LIST of the STAFFS of the ROYAL GARDENS, Kew, and of Botanical Departments and Establishments at Home, and in India, and the Colonies, in Correspondence with Kew.

* Trained at Kew. † Recommended by Kew.

Royal Gardens, Kew :—

Director - - -	W. T. Thiselton Dyer, C.M.G., F.R.S., F.L.S.
Assistant-Director - -	D. Morris, M.A., F.L.S.
Assistant (Office) - -	John Aikman.
„ „ - -	J. Burtt Davy.
Keeper of Herbarium and Library	J. G. Baker, F.R.S., F.L.S.
Principal Assistant - -	W. B. Hemsley, F.R.S., A.L.S.
Mycologist - - -	Dr. M. C. Cooke, M.A., A.L.S.
Assistant (Herbarium) -	N. E. Brown, A.L.S.
„ „ - -	R. A. Rolfe, A.L.S.
„ „ - -	C. H. Wright.
„ for India - -	Dr. O. Stapf.
Attendant - - -	J. F. Jeffrey.
Curator of Museums - -	John R. Jackson, A.L.S.
Attendant - - -	J. M. Hillier.
Preparer - - -	George Badderly.
Curator of the Gardens - -	George Nicholson, A.L.S.
Assistant Curator - -	William Watson.
Foremen :—	
Arboretum - - -	William Truelove.
Herbaceous Department -	Daniel Dewar.
Greenhouse and Ornamental Department.	Frank Garrett.
Temperate House (Sub-tropical Department).	William J. Bean.

Cambridge.—University Botanic Garden :—

Professor - -	Charles C. Babington, F.R.S., F.L.S.
Secretary to Botanic Garden Syndicate.	Dr. Francis Darwin, F.R.S., F.L.S.
Curator - -	*Richard Irwin Lynch, A.L.S.

Dublin.—Royal Botanic Gardens, Glasnevin :—

Curator - -	Frederick W. Moore, Cor. Mem. R.H.S.

Trinity College Botanic Gardens :—

Professor - -	Dr. E. Perceval Wright, F.L.S., Sec. R.I.A.
Curator - -	*F. W. Burbidge, M.A., F.L.S.

Edinburgh.—Royal Botanic Gardens :—

Regius Keeper -	Dr. Isaac Bayley Balfour, F.R.S., F.L.S.
Curator - -	Robert Lindsay, F.R.H.S.

Glasgow.—Royal Botanic Institution :—

University Professor	Dr. F. O. Bower, F.R.S., F.L.S.
Curator - -	Robert Bullen, F.R.H.S.

Oxford.—University Botanic Garden :—

Professor - -	Dr. Sydney H. Vines, F.R.S., F.L.S.
Curator - -	*William Baker, F.R.H.S.

COLONIES.

Antigua. (*See* Leeward Islands.)

Barbados.—Dodd's Reformatory, Botanical Station :—

Superintendent -	John R. Bovell.

British Guiana.—Botanical Gardens :—

Georgetown -	Superintendent and Government Botanist.	*George S. Jenman, F.L.S.
	Head Gardener -	†John F. Waby.
	Second „ -	*Robert Ward.
	Promenade Garden :—	
	Head Gardener -	William Jackson.
Berbice - -	Keeper - -	Richard Hunt.

Canada.—

Ottawa - -	Dominion Botanist -	Prof. John Macoun, M.A., F.R.S.C., F.L.S.
	Assistant „ -	Jas. M. Macoun.
	Director of Government Experimental Farms.	Prof. Wm. Saunders, F.R.S.C., F.L.S.
	Botanist and Entomologist.	James Fletcher, F.L.S.
Montreal -	Director, Botanic Garden.	Prof. Penhallow, B.Sc.

Cape Colony.—Gardens and Public Parks :—

Cape Town -	Director - -	Prof. MacOwan, F.L.S.
	Head Gardener -	H. J. Chalwin.
Grahamstown -	Curator - -	Edwin Tidmarsh.
Port Elizabeth (St. George's Park) :—		
	Superintendent -	John T. Butters.
King Williamstown	Curator - -	*T. R. Sim.
Graaf Reinet -	„ - -	J. C. Smith.
Uitenhage -	„ - -	H. Fairey.

Ceylon.—Department of Royal Botanical Gardens :—

	Director - -	†Dr. Henry Trimen, F.R.S., F.L.S.
Peradeniya -	Head Gardener -	*Peter D. G. Clark.
	Clerk and Foreman	J. A. Ferdinandus.
	Draughtsman -	W. de Alwis.

Ceylon—*continued.*

Hakgala	Superintendent	*William Nock.
	Clerk and Foreman	M. G. Perera.
Henaratgoda	Conductor	A. de Zoysa, Muhandiram.
Anuràdhapura	,,	S. de Silva, Arachchi.
Badulla	,,	D. Guneratne.

Dominica. (*See* Leeward Islands.)

Fiji.—Botanical Station :—

	Curator	*Daniel Yeoward.

Gold Coast.—Botanical Station :—

	Curator	*William Crowther.

Grenada.—Botanical Garden :—

	Curator	†George W. Smith.

Hong Kong.—Botanical and Afforestation Department :—

	Superintendent	†Charles Ford, F.L.S.
	Assistant Superintendent.	*W. J. Tutcher.

Jamaica.—Department of Public Gardens and Plantations :—

	Director	†William Fawcett, B.Sc., F.L.S.
Hope Gardens	Superintendent	*William Harris.
Castleton Garden	,,	Eugene Campbell.
Cinchona (Hill) Garden.	,,	*William Cradwick.
Kingston Parade Garden.	,,	Joseph Harris.
King's House Garden.	,,	*William J. Thompson.
Bath	Overseer	W. Groves.

Lagos.—Botanical Station :—

	Curator	*Henry Millen.

Leeward Islands.—Botanical Department :—

	Superintendent	†Charles A. Barber, B.A., (Cantab.)
Botanical Stations :—		
Antigua	Curator	*Arthur C. Tillson.
Dominica	,,	*Henry F. Green.
Montserrat	,,	Joseph Wade.
St. Kitts—Nevis	,,	*Charles Plumb.

Malta.—Botanical Garden :—

	Director	Dr. Francesco Debono.

Mauritius.—Department of Forests and Botanical Gardens :—

Pamplemousses	Director	*John Horne, F.L.S.
	Assistant	*William Scott.
Curepipe	Overseer	William A. Kennedy.

Montserrat. (*See* Leeward Islands.)

Natal.—Botanical Gardens :—

Durban	Curator	John Medley Wood, A.L.S.
Pietermaritzburg	„	G. Mitchell.

New South Wales.—Botanical Gardens :—

Sydney	Director	Charles Moore, F.L.S.

New Zealand :—

Wellington.—Colonial Botanic Garden :—

	Director	Sir James Hector, K.C.M.G., F.R.S.
	Head Gardener	G. Gibb.
Dunedin	Superintendent	J. McBean.
Napier	„	W. Barton.
Invercargill	Head Gardener	Thomas Wangle.
Auckland	Ranger	William Goldie.
Christchurch	Head Gardener	*Ambrose Taylor.

Queensland.—Botanical Department :—

Brisbane	Colonial Botanist	F. M. Bailey, F.L.S.

Botanical Gardens :—

	Curator	*Philip MacMahon.
	Overseer	J. Tobin.

Acclimatisation Society's Gardens :—

	Secretary and Manager	Wm. Soutter.
	Assistant. Do.	A. Humphrey.
Rockhampton	Superintendent	J. S. Edgar.

St. Kitts—Nevis. (*See* Leeward Islands.)

St. Lucia.—Botanical Station :—

	Curator	†John Gray.

St. Vincent.—Botanical Station :—

	Curator	*Henry Powell.

South Australia.—Botanical Gardens :—

Adelaide	Director	Maurice Holtze, F.L.S.
Port Darwin	Curator	Nicholas Holtze.

Straits Settlements.—Gardens and Forest Department :—

Singapore	Director	†H. N. Ridley, M.A, F.L.S.
	Head Gardener	*Walter Fox.
Penang	Assistant Superintendent.	†Charles Curtis.
Malacca	„	*Robert Derry.

Tasmania.—Botanical Gardens :—

Hobart Town	Superintendent	F. Abbott.

Trinidad.—Royal Botanical Gardens :—

Superintendent	†John H. Hart, F.L.S.
Assistant ,,	*Walter E. Broadway.

Tobago.—Botanical Station :—

Curator	Manuel Ribiero.

Victoria :—

Melbourne	Government Botanist	Sir F. von Mueller, F.R S., F.L.S., K.C.M.G.

Botanical Gardens :—

Director	W. R. Guilfoyle, F.L.S.

INDIA.

Botanical Survey, Director, Dr. George King, C.I.E., LL.D., F.R.S., F.L.S.

Bengal, Assam, Burma; the Andamans and Nicobars; North-East Frontier Expeditions :—

Superintendent of the Royal Botanical Gardens, Calcutta.	Dr. George King, C.I.E., LL.D., F.R.S., F.L.S.

Bombay, including Sind :—

Principal of the College of Science, Poona, Bombay.	Dr. T. Cooke.

Madras; the State of Hyderabad and the State of Mysore :—

Government Botanist† and Director of Cinchona Plantations.	M. A. Lawson, M.A., F.L.S.

Western Provinces and Oudh; the Punjab; the Central Provinces; Central India; Rajputana; North-West Frontier Expeditions :—

Director of the Botanical Department, Northern India, Saharanpur, N.W.P.	J. F. Duthie, B.A., F.L.S.

Bengal.—Department of Royal Botanic Gardens :—

Calcutta (**Seebpore**)	Superintendent	Dr. George King, C.I.E., LL.D., F.R.S., F.L.S.
	Curator of Herbarium	Dr. David Prain, F.L.S., F.R.S.E.
	,, Garden	*Robert L. Proudlock.
	Assistant do.	*G. T. Lane.
Mungpoo	Superintendent, Government Cinchona Plantations.	Dr. George King, C.I.E., LL.D., F.R.S., F.L.S.
	Resident Manager	*J. A. Gammie.
	1st Assistant	*R. Pantling.
	2nd ,,	*Joseph Parkes.
	3rd ,,	G. Gammie.
	4th ,,	*Amos Hartless.
Darjeeling	Curator, Lloyd Botanic Garden.	*William A. Kennedy.
Darbhangah	Superintendent, Maharajah's Garden.	Herbert Thorn.

Bombay :—

Poona	Principal, College of Science (in charge of Botanical Survey).	Dr. T. Cooke.
	Lecturer on Botany	*G. Marshall Woodrow.
Ghorpuri.—Botanical Garden :—		
	Superintendent	A. R. Lester.
Bombay.—Municipal Garden :—		
	Superintendent	†G. H. Carstensen.

Madras.—Botanical Department :—

Ootacamund	Government Botanist and Director of Government Gardens, Parks, and Cinchona Plantations.	†M. A. Lawson, M.A., F.L.S.
	Curator of Gardens and Parks.	*Andrew Jamieson.
Madras.—Agri-Horticultural Society :—		
	Secretary	Edgar Thurston.
	Superintendent	*J. M. Gleeson.

Native States :—

Mysore (Bangalore)	Superintendent	*J. Cameron, F.L.S.
	Head Gardener	*J. Horne Stephen.
Baroda	Superintendent	*J. M. Henry.
Gwalior	„	†C. Maries, F.L.S.
Morvi	„	*Joseph Beck.
Udaipur	„	*T. H. Storey.

North-West Provinces :—

Agra (Taj Garden)	Superintendent	*A. B. Westland.
Allahabad	„	J. Phillips.
Cawnpur	„	G. H. T. Mayer.
Lucknow	„	*Matthew Ridley.
Saharanpur and Branch Garden, Mussoorie.	„	William Gollan.

Punjab :—

Lahore	Superintendent	J. Phillips.
Simla	„	A. Parsons.

[*All Rights Reserved.*]

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX IV.—1891.

INDEX, KEW BULLETIN, 1887–91.

The first number of the *Kew Bulletin* was published in January 1887. At first it was proposed to issue it only occasionally whenever matter of sufficient interest for publication had accumulated. It was, however, at once found necessary to publish it monthly, and in deference to the suggestion of subscribers further space has since been obtained by relegating to appendices information of a purely formal kind. So far sixty numbers have been issued with six appendices.

The subjects treated have related almost entirely to economic botany. The results of investigations made by members of the staff at Kew and of kindred institutions at home and abroad on vegetable products and the plants producing them, have been carefully summarised and presented in as concise and clear a manner as possible. In many cases the articles have been illustrated by plates from original drawings or

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C., and
32, ABINGDON STREET, WESTMINSTER, S.W.; or
JOHN MENZIES & Co., 12, HANOVER STREET, EDINBURGH, and
90, WEST NILE STREET, GLASGOW; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1891.
Price Twopence.

4

by those placed at the disposal of the Director by the Bentham Trustees from the *Icones Plantarum*. The kind of information furnished by the *Bulletin* has evidently proved of great general interest. It has become an expeditious mode of communicating this information to persons at home, to the numerous correspondents officially connected with Colonial and Indian botanical establishments, and to private persons interested in plant products in distant parts of the Empire. It has also been of service to members of the general public engaged in planting or agricultural business in India and the Colonies.

An index to the five yearly volumes already published, has been prepared for convenience of reference to their contents. This is intended to be bound at the end of the volume for 1891.

A.

Abrus precatorius, 1890; 13.
Abyssinian cereals, Teff, 1887, January; 2.
Acacia Angico, 1888; 128.
Aden barilla, 1891; 96.
Africa, South, Cape boxwood, 1887, February; 1.
— — fruits, 1888; 15.
— — Phylloxera, 1889; 230.
— — — regulations, 1889; 255.
— — prickly-pear, 1888; 165. 1890; 186.
— West, annatto, 1890; 141.
— — Assam rubber in, 1891; 97.
— — bass fibre, 1891; 1.
— — cotton, 1890; 135. 1891; 49.
— — cultural industries, 1889; 142. 1890; 195, 261.
— — fruits, 1888; 221.
— — indigo plants, 1888; 74.
— — rubbers, 1888; 253. 1889; 63. 1890; 89.
African oil palm, 1889; 259. 1891; 190.
Agave heteracantha, 1887, December; 5. 1890; 220.
— rigida var. sisalana, 1887, March; 3. 1889; 57, 254. 1890; 158. 1891; 175.
— vivipara, 1890; 50.
Agricultural industries at the Gambia, 1889; 142. 1890; 261.
— — in the Bahamas, 1891; 175.
Alexandria, mealy-bug, 1890; 94. 1891; 48.
Aloe fibre, Bombay, 1890; 50.
Aloes, Natal, 1890; 163.
Alpinia Galanga, 1891; 5.
America, Central, rubber, 1887, December; 13.
Ananas sativus, 1887, April; 8.
Angico, 1888; 128.
Anguilla, report of Mr. Morris's visit, 1891; 129.
Anise, star, 1888; 173.
Annatto, 1887, July; 1. September; 1. 1890; 141.
Anona Cherimolia, 1887, August; 15.
Antiaris toxicaria, 1891; 25, 259.
Argel leaves, 1891; 177.
Aristolochia odoratissima, 1887, December; 10.
Aristotelia Maqui, 1890; 34.
Arracacia esculenta, 1887, August; 10.
Artificial coffee-beans, 1891; 201.
Asia Minor, Phylloxera, 1889; 66.
Aspidiotus aurantii, 1890; 95.
— — in Cyprus, 1891; 221.
Assam rubber for West Africa, 1891; 97.
Attalea funifera, 1889; 237.
Australia, introduction of Brazil-nut, 1887, December; 11.
— South, fruits, 1888; 6.
— Western, fruits, 1888; 10.

B.

Bahamas fibre industry, 1889; 57, 254. 1890; 158. 1891; 175.
— fruits, 1888; 180.
— industries, 1891; 175.

Bahia piassava, 1889; 237.
Bambusa Tulda, 1887, December; 8.
Banana and plantain fibre, 1887, April; 5.
— disease in Fiji, 1890; 272.
Barbados fruits, 1888; 184.
— mites on sugar-cane, 1890; 85.
— report of Mr. Morris's visit, 1891; 152, 158.
— sugar-cane seedlings, 1888; 294. 1889; 242. 1891; 10.
Barilla, 1890; 56.
— Aden, 1891; 96.
Bark, Loxa, commercial value of, 1890; 54.
Barley, huskless, 1888; 271.
Barrel staves, insect injury, 1890; 181.
Bass fibre of West Africa, 1891; 1.
Bavarian forest plague, 1890; 224.
Bean, yam, 1889; 17, 62.
— short-podded yam, 1889; 121.
Beetles destructive to rice-crops in Burma, 1889; 13.
Ben, oil of, 1887, January; 7.
Bengal, manufacture of Purree or Indian yellow, 1890; 45.
— rice cultivation, 1888; 284.
Bermuda fruits, 1888; 216.
— onion-disease, 1887, October; 1.
Berries, Maqui, for colouring wine, 1890; 34.
Bertholletia excelsa, 1887, December; 11.
Beverages:—
  Cacao, 1890; 170.
  Coffee, 1888; 129, 261. 1890; 107, 245.
  — beans (artificial), 1891; 201.
  — Mussænda, 1889; 281.
  Economic plants of Madagascar, 1890; 200.
  Tea, 1888; 86.
  — compressed or tablet, 1890; 109.
  — P'u-êrh, 1889; 118, 139.
  Wine production in France, 1890; 174.
Bhabur grass, 1888; 157.
Bixa Orellana, 1887, July; 1. September; 1. 1890; 141.
Boehmeria nivea, 1888; 145, 273, 297. 1889; 268, 284. 1890; 174.
— — var. tenacissima, 1888; 145, 273, 297. 1889; 268, 284.
— — as food for silkworms, 1890; 174.
Bolo-bolo fibre, 1889; 15.
Bombay aloe fibre, 1890; 50.
Botanical departments, 1889; 122. 1890; 175. 1891; App. iii.
— enterprise in the Niger Protectorate, 1891; 84.
— — in the West Indies, 1891; 103.
— exploration of Cuba, 1890; 37.
— literature of the British Empire, guide to, 1889; 153.
— station, Gold Coast, 1891; 169.
— — at Lagos, 1888; 149. 1889; 69. 1890; 162. 1891; 46.
— stations in the West Indies, 1887, June; 1. July; 9.
Botany of the Gambia Delimitation Commission, 1891; 268.
Bouillie bordelaise, 1888; 270. 1889; 230. 1890; 190.
Bowstring hemp, 1887, May; 1.
Boxwood, Cape, 1887, February; 1.
Brassica chinensis, 1888; 137.
Brazilian gum-arabic, 1888; 128.
Brazil-nut, introduction to East Indies and Australia, 1887, December; 11.
Bread, chiga, 1889; 71.
British Empire, guide to the botanical literature of, 1889; 153.
— Guiana fruits, 1888; 192.
Bromeliad, a starch-yielding, 1889; 20.
Broom-root or Mexican whisk, 1887, December; 9.
Buazé fibre, 1889; 222.
Buckwheat, Kangra, 1891; 244.
Bug, mealy, at Alexandria, 1890; 94. 1891; 48.
Bulbs and flowers of lilies used as food, 1889; 116.
Burma, beetles destructive to rice-crops, 1889; 13.
— Upper, india-rubber, 1888; 217.

Butter, cocoa-nut, 1890; 230.
Buxus Macowani, 1887, February; 1.

C.

Cabbage, Shantung, 1888; 137.
Cacao, Ceylon, 1890; 170.
Caicos fibre production, 1890; 273.
Caledonia, New, dammar, 1891; 76.
Calligonum flowers, 1889; 217.
Camellia Sasanqua, 1888; 264.
— theifera, 1888; 86.
Campsiandra comosa, 1889; 71.
Canadian fruits, 1887, November; 1.
Canaigre, 1890; 63.
Cane-sugar in the sugar-cane, 1891; 35.
Cape boxwood, 1887, February; 1.
— fruits, 1888; 15.
— Phylloxera, 1889; 230.
— — regulations, 1889; 255.
— prickly-pear, 1888; 165. 1890; 186.
Castanea sativa flour, 1890; 173.
Castilloa elastica, 1887, December; 13.
Cayman Islands, 1888; 160.
Central America, rubber, 1887, December; 13.
— China, vegetable productions, 1889; 225.
Cephaelis Ipecacuanha, 1888; 123.
— tomentosa, 1888; 269.
Cereals:—
  Bambusa Tulda, 1887, December; 8.
  Coix gigantea, 1888; 266.
  Dendrocalamus strictus, 1889; 283.
  Huskless barley, 1888; 271.
  Kangra buckwheat, 1891; 244.
  Panicum flavidum, 1887, December; 8.
  Teff, 1887, January; 2.
Ceylon cacao, 1890; 170.
— fruits, 1888; 248.
Cherimoyer, 1887, August; 15.
Chestnut flour, 1890; 173.
Chiga bread, 1889; 71.
China, Central, vegetable productions, 1889; 225.
China grass, 1888; 145, 273, 297. 1889; 268, 284.
Chinese fibres, 1891; 247.
— ginger, 1891; 5.
Chocho, 1887, August; 6.
Chœtocnema basalis in Burma, 1889; 13.
Chrozophora tinctoria, 1889; 279.
Cinchona in India, 1888; 139. 1890; 29.
— — Jamaica, 1889; 244. 1890; 54.
Climate of Zanzibar, 1890; 216.
Coca, 1889; 1.
— earliest notice of, 1889; 221.
Cocoa-nut butter, 1890; 230.
— — coir from Lagos, 1889; 129.
Cochin-China vine, 1888; 134.
Cocos nucifera, 1887, September; 7. 1889; 129. 1890; 230.
Coffee-beans, artificial, 1891; 201.
— Liberian, 1890; 107, 245.
— — at the Straits Settlements, 1888; 261. 1890; 107.
— Mussænda, 1889; 281.
— Trinidad, 1888; 129.
Cogwood, Jamaica, 1889; 127.
Coir, cocoa-nut, from Lagos, 1889; 129.
Coix gigantea, 1888; 266.
— Lachryma, var. stenocarpa, 1888; 144.
Cola-nut, 1890; 253.
Collecting fungi, 1889; 257.
Colombian india-rubber, 1890; 149.
Colonial and Indian Exhibition 1886, 1887, September; 4.
— botanical departments, 1889; 122. 1890; 175. 1891; App. iii.
— cultivation of perfumery plants, 1890; 269.
— fruit, 1887, November; 1. 1888; 1, 177, 197, 221.
Colouring matters:—
  Annatto, 1887, July; 1. September; 1. 1890; 141.
  Contributions from Colonial and Indian Exhibition 1886, 1887, September; 4.
  Indigo, 1888; 74, 268.
  — Yoruba, 1888; 74, 268.
  Madagascar plants, 1890; 200.

Colouring matters—*cont.*
  Maqui berries, 1890; 34.
  Persian Zalil, 1889; 111.
  Purree or Indian yellow, 1890; 45.
Colouring wine with Maqui berries, 1890; 34.
Commercial value of Loxa bark, 1890; 54.
Compressed or tablet tea, 1890; 109.
Contrayerva, 1887, December; 10.
Cool cultivation of tropical and sub-tropical plants, 1889; 287.
Copaifera gorskiana, 1888; 281.
Copal, Inhambane, 1888; 281.
Cotton in West Africa, 1890; 135. 1891; 49.
Crossotosoma [*Icerya*] ægyptiacum, 1890; 94. 1891; 48.
Cuba botanical exploration, 1890; 37.
Cubebs, 1887, December; 1.
Cudrania triloba, 1888; 291.
Cultivation and soil in Yorubaland, 1890; 238.
— cool, of tropical and sub-tropical plants, 1889; 287.
— of perfumery plants in the Colonies, 1890; 269.
— — pistachio in Cyprus, 1890; 69.
— — rice in Bengal, 1888; 284.
— — vine in the Gironde, 1889; 227.
— — — — Tunis, 1890; 36.
Cultural industries at the Gambia, 1889; 142. 1890; 261.
— — in West Africa, 1890; 195.
Culture of vine in Tunis, 1890; 36.
Cutch, pale, or Kath, 1891; 31.
Cyphomandra betacea, 1887, August; 2.
Cyprus fruits, 1888; 245.
— orange scale-insect, 1891; 221.
— pistachio cultivation, 1890; 69.
— valonia, 1888; 163.
— wheat pest, 1889; 133.
Cytisus proliferus, 1891; 239.

D.

Dammar from New Caledonia, 1891; 76.
Deccan hemp or Kanaff, 1891; 204.
Delphinium Zalil, 1889; 111.
Demerara pink-root, 1888; 265.
— rubber, 1888; 69.
Dendrocalamus strictus, 1889; 283.
Departments, staffs, 1889; 122. 1890; 175. 1891; App. iii.
Dichopsis Gutta at Singapore, 1891; 230.
Disease, banana, in Fiji, 1890; 272.
— onion, at Bermuda, 1887, October; 1.
Dominica fruits, 1888; 197.
— report of Mr. Morris's visit, 1891; 115.
Dorstenia brasiliensis, 1887, December; 10.
— Contrayerva, 1887, December; 10.
Drugs:—
  Alpinia Galanga, 1891; 5.
  Argel leaves, 1891; 177.
  Chinese ginger, 1891; 5.
  Cinchona, 1888; 139. 1889; 244. 1890; 29, 54.
  Coca, 1889; 1, 221.
  Cola nut, 1890; 253.
  Contrayerva, 1887, December 10.
  Contributions from Colonial and Indian Exhibition 1886, 1887, September; 4.
  Cubebs, 1887, December; 1.
  Demerara pink-root, 1888; 265.
  Ipecacuanha, 1888; 123.
  — Trinidad, 1888; 269.
  Loxa bark, 1890; 54.
  Madagascar plants, 1890; 200.
  Natal aloes, 1890; 163.
  Paraguay jaborandi, 1891; 179.
Dyes:—
  Contributions from Colonial and Indian Exhibition 1886, 1887, September; 4.
  Indigo, 1888; 74, 268.
  — Yoruba, 1888; 74, 268.
  Madagascar plants, 1890; 200.
  Persian Zalil, 1889; 111.

E.

Earliest notice of Erythroxylon Coca, 1889; 221.
East Indies, introduction of Brazil-nut, 1887, December; 11.
— — introduction of West Indian food plants, 1887, August 1. 1889; 17.
Ebony, Madagascar, 1888; 135.
Economic contributions, Colonial and Indian Exhibition 1886, 1887, September; 4.
— plants of Madagascar, 1890; 200.
Edible fungus of New Zealand, 1890; 217.
Egyptian cotton, 1890; 135. 1891; 49.
Elæis guineensis, 1891; 190.
— — in Labuan, 1889; 259.
Empire, British, guide to botanical literature, 1889; 153.
Epicampes macroura, 1887, December; 9.
Eragrostis abyssinica, 1887, January; 2.
Erythroxylon Coca, 1889; 1.
— — var. nova-granatense, 1889; 1.
— — earliest notice of, 1889; 221.
Eucalyptus, hardy species of, 1889; 61.
— marginata, 1890; 188.
Exhibition, Colonial and Indian, 1886, articles contributed, 1887, September; 4.
Exploration, botanical, of Cuba, 1890; 37.

F.

Fagopyrum tataricum var., 1891; 244.
Fibres:—
  Bahamas hemp (*Agave*), 1889; 57, 254. 1890; 158. 1891; 175.
  Bahia piassava, 1889; 237.
  Banana and plantain fibre, 1887, April; 5.
Fibres—*cont.*
  Bhabur grass, 1888; 157.
  Bolo-bolo fibre, 1889; 15.
  Bombay aloe fibre, 1890; 50.
  Bowstring hemp, 1887, May; 1.
  Buazé fibre, 1889; 222.
  Chinese fibres, 1891; 247.
  Cocoa-nut coir, 1889; 129.
  Contributions from Colonial and Indian Exhibition 1886, 1887, September; 4.
  Egyptian cotton, 1890; 135. 1891; 49.
  Fibre plants, 1887, March; 1.
  — production in the Caicos, 1890; 273.
  Honckenya fibre, 1889; 15.
  Kanaff or Deccan hemp, 1891; 204.
  Keratto fibre, 1891; 133.
  Madagascar fibre plants, 1890; 200.
  Manila hemp, 1887, April; 1.
  Mauritius hemp, 1887, March; 8.
  — — machines, 1890; 98.
  Mexican fibre or Istle, 1887, December; 5. 1890; 220.
  Okro fibre, 1890; 229.
  Pine-apple fibre, 1887, April; 8.
  Ramie or Rheea, 1888; 145, 273, 297. 1889; 268, 284.
  Sansevieria fibre, 1887, May; 1.
  Siberian perennial flax, 1890; 104.
  Sisal hemp (*Agave*), 1887, March; 3.
  Urera fibre, 1888; 84.
  West African bass fibre, 1891; 1.
Ficus elastica for West Africa, 1891; 97.
— Vogelii, 1888; 253. 1890; 89.
Fiji banana disease, 1890; 272.
Flavouring materials and spices:—
  Alpinia Galanga, 1891; 5.
  Economic plants of Madagascar, 1890; 200.
  Star anise, 1888; 173.
  Vanilla, 1888; 76.
Flax, Siberian perennial, 1890; 104.
Fleshy fungi, 1889; 257.
Flour, chestnut, 1890; 173.

Flowers and bulbs of lilies used as food, 1889; 116.
— of Calligonum, 1889; 217.

Fluted scale-insect (Icerya), 1889; 191.

Fodder plants: tagasaste, 1891; 239.

Food for silkworms (Ramie), 1890; 174.
— — grains of India, 1887, December; 7. 1888; 266. 1889; 283.
— — plants introduced to East Indies, 1887, August; 1. 1889; 17.

Foods and beverages:—
  Alpinia Galanga, 1891; 5.
  Anona Cherimolia, 1887, August; 15.
  Arracacha, 1887, August; 10.
  Bamboo shoots, 1887, December; 8.
  Bambusa Tulda, 1887, December; 8.
  Brazil-nut, 1887, December; 11.
  Bulbs and flowers of lilies, 1889; 116.
  Cacao, 1890; 170.
  Calligonum flowers, 1889; 217.
  Cereals, 1887, January; 2. December; 7. 1888; 266, 271. 1889; 283. 1891; 244.
  Chestnut flour, 1890; 173.
  Chiga bread, 1889; 71.
  Chinese ginger, 1891; 5.
  Chocho, 1887, August; 6.
  Cocoa-nut butter, 1890; 230.
  Coffee, 1888; 129, 261. 1890; 107, 245.
  — beans (artificial), 1891; 201.
  — Mussænda, 1889; 281.
  Coix gigantea, 1888; 266.
  Colonial fruits, 1887, November; 1. 1888; 1, 177, 197, 221.
  Contributions from Colonial and Indian Exhibition 1886, 1887, September; 4.
  Dendrocalamus strictus, 1889; 283.
  Economic plants of Madagascar, 1890; 200.

Foods and beverages—*cont.*
  Edible fungus of New Zealand, 1890; 217.
  Fruits, 1887, August; 2, 15. November; 1. 1888; 1, 177, 197, 221. 1889; 21. 1890; 34.
  Hibiscus esculentus, 1890; 229.
  Huskless barley, 1888; 271.
  Kangra buckwheat, 1891; 244.
  Maqui berries, 1890; 34.
  Mysore fruits, 1889; 21.
  Panicum flavidum, 1887, December; 8.
  Pistachio nut, 1890; 69.
  Puya edulis, 1889; 20.
  Saccharine, 1888; 23.
  Shantung cabbage, 1888; 137.
  Star anise, 1888; 173.
  Sugar, Indian, 1890; 71.
  — production of the world; 1890; 38.
  Tea, 1888; 86.
  — compressed or tablet, 1890; 109.
  — P'u-êrh, 1889; 118, 139.
  Teff, 1887, January; 2.
  Tree tomato, 1887, August; 2.
  Vanilla, 1888; 76.
  Wine production in France, 1890; 174.
  Yam-bean, 1889; 17, 62.
  — — short-podded, 1889; 121.

Forest plague in Bavaria, 1890; 224.

Forsteronia floribunda, 1888; 292.
— gracilis, 1888; 69.
— rubber, 1888; 69.

France, South, production of prunes, 1890; 263.
— treatment of vines, 1888; 270. 1889; 227. 1890; 190.
— wine production, 1890; 174.

Fruits, Colonial:—
  Canada, 1887, November; 4.
  Cape Colony, 1888; 15.
  Ceylon, 1888; 248.
  Cyprus, 1888; 245.
  Malta, 1888; 234.
  Mauritius, 1888; 20.
  Natal, 1888; 225.
  New Zealand, 1888; 13.
  St. Helena, 1888; 252.
  South Australia, 1888; 6.
  Straits Settlements, 1888; 250.

Fruits, Colonial—*cont.*
  Tasmania, 1888 ; 11.
  Victoria, 1888 ; 2.
  West Africa, 1888 ; 221.
  — Australia, 1888 ; 10.
  — Indies, 1888 ; 177, 197.
Fruits of Mysore, 1889 ; 21.
Fungi, fleshy, 1889 ; 257.
Fungus, an edible, of New Zealand, 1890 ; 217.
Furcræa gigantea, 1887, March ; 8. 1890 ; 98.

G.

Gærtnera vaginata, 1889 ; 281.
Gambia, cultural industries, 1889 ; 142. 1890 ; 261.
— Delimitation Commission, botany of, 1891 ; 268.
— mahogany, 1890 ; 168.
Gambier, 1889 ; 247.
— in West Indies, 1891 ; 109, 110.
Garden orchids, new : decade i., 1891 ; 197.
— plants, new, 1888 ; 89. 1889 ; 73. 1890 ; App. ii. 1891 ; App. ii.
Ginger, Chinese, 1891 ; 5.
Gironde, cultivation of vine, 1889 ; 227.
Gold Coast botanical station, 1891 ; 169.
— — Egyptian cotton, 1890 ; 135. 1891 ; 49.
— — fruits, 1888 ; 223.
Grain preservation from weevils, 1890 ; 144.
Grains, food-, of India, 1887, December ; 7. 1888 ; 266. 1889 ; 283.
Grass, Bhabur, 1888 ; 157.
Greece, erroneous report of Phylloxera, 1889 ; 236.
Grenada fruits, 1888 ; 188.
— report of Mr. Morris's visit, 1891 ; 145.
Guide to botanical literature of British Empire, 1889 ; 153.
Gum-arabic, Brazilian, 1888 ; 128.
Gums and resins :—
  Brazilian gum-arabic, 1888 ; 128.
  Contributions from Colonial and Indian Exhibition 1886, 1887, September ; 4.
  Economic plants of Madagascar, 1890 ; 200.
  Inhambane copal, 1888 ; 281.
  New Caledonian dammar, 1891 ; 76.
Gutta Percha, new process for recovering ; 1891 ; 231.
— — tree, rediscovery of, at Singapore, 1891 ; 230.

H.

Halogeton sativus, 1890 ; 56.
Hardy species of Eucalyptus, 1889 ; 61.
Hemp, Sisal, 1887, March ; 3.
— Bahamas, 1889 ; 57, 254. 1890 ; 158. 1891 ; 175.
— Bowstring, 1887, May ; 1.
— Chinese, 1891 ; 247.
— Deccan, or Kanaff, 1891 ; 204.
— Manila, 1887, April ; 1.
— Mauritius, 1887, March ; 8.
— — machines, 1890 ; 98.
Herbaceous plants, list of seeds, 1888 ; 25. 1889 ; 29. 1890 ; App. i. 1891 ; App. i.
Hibiscus cannabinus, 1891 ; 204.
— esculentus, 1890 ; 229.
Hirneola polytricha, 1890 ; 217.
Historical account of Kew to 1841, 1891 ; 279.
Honckenya ficifolia, 1889 ; 15.
Huskless barley, 1888 ; 271.
Hymenæa Courbaril, 1888 ; 128.

I.

Icerya Purchasi, 1889 ; 191.
— (*Crossotosoma ægyptiacum*), 1890 ; 94. 1891 ; 48.
Illicium verum, 1888 ; 173.
Index to Kew Reports, 1862–82, 1890 ; App. iii.

India, Bombay aloe fibre, 1890; 50.
— botanical departments, 1889; 122. 1890; 175. 1891; App. iii.
— food-grains, 1887, December; 7. 1888; 266. 1889; 283.
— fruits of Mysore, 1889; 21.
— manufacture of Purree or Indian yellow, 1890; 45.
— — of quinine, 1888; 139. 1890; 29.
— N.W., flowers of Calligonum, 1889; 217.
— rice-cultivation, Bengal, 1888; 284.
Indian sugar, 1890; 71.
— yellow, 1890; 45.
India-rubber, Assam, for West Africa, 1891; 97.
— — Castilloa, 1887, December; 13.
— — Colombian, 1890; 149.
— — Forsteronia, 1888; 69.
— — in Upper Burma, 1888; 217.
— — Jamaica, 1888; 292.
— — West African, 1888; 253. 1889; 63. 1890; 89.
Indigenous plants of Yoruba-land, 1891; 206.
Indigo plants, West African, 1888; 74.
— Yoruba, 1888; 74, 268.
Industries at the Bahamas, 1889; 57, 254. 1890; 158. 1891; 175.
— — Mauritius, 1887, February; 4.
— cultural, at the Gambia, 1889; 142. 1890; 261.
— — in West Africa, 1890; 195.
Inhambane copal, 1888; 281.
Insect, fluted scale, 1889; 191.
— injury to barrel staves, 1890; 181.
— orange scale, 1891; 221.
Introduction of Brazil-nut to East Indies and Australia, 1887, December; 11.
— — West Indian food plants to East Indies, 1887, August; 1. 1889; 17.
Ipecacuanha, 1888; 123.
— Trinidad, 1888; 269.
Ipoh poison of the Malay Peninsula, 1891; 25, 259.
Ischæmum angustifolium, 1888; 157.
Islands, Cayman, 1888; 160.
Istle or Mexican fibre, 1887, December; 5. 1890; 220.

J.

Jaborandi, Paraguay, 1891; 179.
Jamaica cinchona, 1889; 244. 1890; 54.
— cogwood, 1889; 127.
— contrayerva, 1887, December; 10.
— fruits, 1888; 178.
— india-rubber, 1888; 292.
— report of Mr. Morris's visit, 1891; 154.
— tea, 1888; 86.
— yam bean, 1889; 17, 62.
Jarrah timber, 1890; 188.
Job's tears, 1888; 144.
Journey in Nyassaland, 1891; 183.

K.

Kanaff or Deccan hemp, 1891; 204.
Kangra buckwheat, 1891; 244.
Kath or pale cutch, 1891; 31.
Keratto fibre, 1891; 133.
Kew, historical account to 1841, 1891; 279.
— list of seeds of herbaceous plants, 1888; 25. 1889; 29. 1890; App. i. 1891; App. i.
— — — — — trees and shrubs, 1890; App. i. 1891; App. i.
— — — staffs, &c., &c., 1889; 122. 1890; 175. 1891; App. iii.
— orchids, 1891; 52.
— Reports 1862–82, index, 1890; App. iii.
Khaya senegalensis, 1890; 168.

L.

Labuan, oil palm, 1889; 259.
Lagos botanical station, 1888; 149. 1889; 69. 1890; 162. 1891; 46.
— cocoa-nut coir, 1889; 129.
— fibre, 1889; 15.
— fruits, 1888; 224.
— rubber, 1888; 253. 1890; 89.
Leeward Islands, report of Mr. Morris's visit, 1891; 111.
Liberian coffee, 1890; 107, 245.
— — at the Straits Settlements, 1888; 261. 1890; 107.
Lily flowers and bulbs, 1889; 116.
Linum perenne, 1890; 104.
Liparis monacha in Bavaria, 1890; 224.
List of orchids flowered at Kew, 1891; 52.
— — seeds of hardy herbaceous plants, 1888; 25. 1889; 29. 1890; App. i. 1891; App. i.
— — — — trees and shrubs, 1890; App. i. 1891; App. i.
— — staffs of Royal Gardens, Kew, &c., 1889; 122. 1890; 175. 1891; App. iii.
Literature, botanical, of British Empire, 1889; 153.
Lonchocarpus cyanescens, 1888; 74, 268.
Loxa bark, commercial value of, 1890; 54.
Lysiloma Sabicu, 1887, December; 4.

M.

Madagascar ebony, 1888; 135.
— economic plants, 1890; 200.
— tea, 1888; 87.
Mahogany, Gambian, 1890; 158.
Malay Peninsula, Ipoh poison, 1891; 25, 259.
Malta fruits, 1888; 234.
Manila hemp, 1887, April; 1.
Manufacture of quinine in India, 1888; 139. 1890; 29.
Maqui berries for colouring wine, 1890; 34.
Mauritius fruits, 1888; 20.
— hemp, 1887, March; 8.
— — machines, 1890; 98.
— industries, 1887, February; 4.
Mealy-bug [*Icerya*] at Alexandria, 1890; 94. 1891; 48.
Mexican fibre or Istle, 1887, December; 5. 1890; 220.
— whisk or broom-root, 1887, December; 9.
Mildew on vines, treatment, 1888; 270. 1889; 227. 1890; 190.
Miscellaneous notes, 1891; 245, 275.
Mites on sugar-cane, 1890; 85.
Montserrat fruits, 1888; 214.
— report of Mr. Morris's visit, 1891; 119.
Moringa aptera and M. pterygosperma, 1887, January; 7.
Musa sapientum, 1887, April; 5.
— textilis, 1887, April; 1.
Mussænda coffee, 1889; 281.
Mysore fruits, 1889; 21.

N.

Natal aloes, 1890; 163.
— fruits, 1888; 225.
— tea, 1888; 87.
— Urera fibre, 1888; 84.
Nevis and St. Kitts fruits, 1888; 215.
— — — — report of Mr. Morris's visit, 1891; 124.
New Caledonia dammar, 1891; 76.
— garden orchids: decade i., 1891; 197.
— — plants, 1888; 89. 1889; 73. 1890; App. ii. 1891; App. ii.
— process for recovering loss of Gutta Percha, 1891; 231.
New Zealand, an edible fungus, 1890; 217.
— — fruits, 1888; 13.
Nicotiana Tabacum, 1891; 77.
Niger Protectorate botanical enterprise, 1891; 84.

Notes, miscellaneous, 1891; 245, 275.
Nyassaland, journey in, 1891; 183.

O.

Œcophora temperatella in Cyprus, 1889; 133.
Oils:—
  African oil palm, 1891; 190.
  — — — in Labuan, 1889; 259.
  Contributions from Colonial and Indian Exhibition 1886, 1887, September; 4.
  Madagascar oil-yielding plants, 1890; 200.
  Oil of Ben, 1887, January; 7.
  Tea oil and oil-cake, 1888; 264.
Okro fibre, 1890; 229.
Onion disease at Bermuda, 1887, October; 1.
Opuntia (prickly-pear) in South Africa, 1888; 165. 1890; 186.
Orange-scale in Cyprus, 1891; 221.
Orchid nomenclature, 1891; 193.
Orchids flowered at Kew, 1891; 52.
— new garden: decade i., 1891; 197.

P.

Pachyrhizus angulatus, 1889; 121.
— tuberosus, 1889; 17, 62.
Palm, African oil, 1891; 190.
— — — in Labuan, 1889; 259.
Panicum flavidum, 1887, December; 8.
Paper from Bhabur grass, 1888; 157.
— streblus, 1888; 81.
Paraguay Jaborandi, 1891; 179.
Patchouli, 1888; 71, 133. 1889; 135.
Pear, prickly, in South Africa, 1888; 165. 1889; 135.
Perak, planting, 1891; 220.
Perennial flax, 1890; 104.
Perfumery plants, cultivation in Colonies, 1890; 269.
Peronospora schleideniana at Bermuda; 1887, October; 1.
Persia, poisoning from Turnsole, 1889; 279.
Persian tobacco or Tombak, 1891; 77.
— Zalil, 1889; 111.
Pest, wheat, in Cyprus, 1889; 133.
Phylloxera, 1891; 44.
— erroneous report of, in Greece, 1889; 236.
— in Asia Minor, 1889; 66.
— — South Africa, 1889; 230.
— — Victoria, 1890; 36.
— regulations at the Cape, 1889; 255.
Piassava, Bahia, 1889; 237.
Pilocarpus pennatifolius, 1891; 179.
Pine-apple fibre, 1887, April; 8.
Pink-root, Demerara, 1888; 265.
Piper Cubeba, 1887, December; 1.
Pistachio cultivation in Cyprus, 1890; 69.
Plague, a forest, in Bavaria, 1890; 224.
Plantain and banana fibre, 1887, April; 5.
Planting in Perak, 1891; 220.
Plant, the weather-, 1890; 1.
Plants, cool cultivation of tropical and sub-tropical, 1889; 287.
— economic, of Madagascar, 1890; 200.
— herbaceous, list of seeds, 1888; 25. 1889; 29. 1890; App. i. 1891; App. i.
— new garden, 1888; 89. 1889; 73. 1890; App. ii. 1891; App. ii.
— perfumery, 1890; 269.
— Schweinfurth's method for preserving, 1889; 19.
— West African indigo, 1888; 74.
Pogostemon Patchouli var. suavis, 1888; 71, 133. 1889; 135.
Poisons:—
  Demerara pink-root, 1888; 265.
  Economic plants of Madagascar, 1890; 200.
  Ipoh poison, 1891; 25, 259.
  Tea-oil cake, 1888; 264.
  Turnsole, poisoning from, 1889; 279.

Preservation of grain from weevils, 1890 ; 144.
Preserving and collecting fleshy fungi, 1889 ; 257.
— plants, Schweinfurth's method, 1889 ; 19.
Prickly-pear in South Africa, 1888 ; 165. 1890 ; 186.
Production of cane-sugar in the sugar-cane, 1891 ; 35.
— of fibre in the Caicos, 1890 ; 273.
— — prunes in the South of France, 1890 ; 263.
— — seed and seminal variation in the sugar-cane, 1891 ; 10.
— — sugar in the world, 1890 ; 38.
— — wine in France, 1890 ; 174.
Productions, vegetable, Central China, 1889 ; 225.
Prunes, production of, in South of France, 1890 ; 263.
P'u-êrh tea, 1889 ; 118, 139.
Purree or Indian yellow, 1890 ; 45.
Puya edulis, 1889 ; 20.

Q.

Queensland, introduction of Brazil-nut, 1887, December ; 11.
— "red rust" on sugar-canes, 1890 ; 86.
Quercus Ægilops, 1888 ; 163.
Quinine manufacture in India, 1888 ; 139. 1890 ; 29.

R.

Ramie or Rheea, 1888 ; 145, 273, 297. 1889 ; 268, 284.
— — — as food for silkworms, 1890 ; 174.
Raphia vinifera, 1891 ; 1.
Red-rust on sugar-canes, 1890 ; 86.
Rediscovery of Gutta Percha tree at Singapore, 1891 ; 230.
Regulations for preventing the introduction of Phylloxera to the Cape, 1889 ; 255.
Report (erroneous) of Phylloxera in Greece, 1889 ; 236.
Reports, Kew, index to, 1890 ; App. iii.
Resins and gums :—
  Brazilian gum-arabic, 1888 ; 128.
  Contributions from Colonial and Indian Exhibition 1886, 1887, September ; 4.
  Economic plants of Madagascar, 1890 ; 200.
  Inhambane copal, 1888 ; 281.
  New Caledonian dammar, 1891 ; 76.
Rheea or Ramie, 1888 ; 145, 273, 297. 1889 ; 268, 284.
— — — as food for silkworms ; 1890 ; 174.
Rice-crops in Burma, beetles destructive to, 1889 ; 13.
— cultivation in Bengal, 1888 ; 284.
Rubber, Assam, for West Africa, 1891 ; 97.
— Castilloa, 1887, December ; 13.
— Colombian, 1890 ; 149.
— Forsteronia, 1888 ; 69.
— in Upper Burma, 1888 ; 217.
— Jamaica, 1888 ; 292.
— Lagos, 1888 ; 253. 1890 ; 89.
— West African, 1889 ; 63.
Rumex hymenosepalum, 1890 ; 63.

S.

Sabicù wood, 1887, December ; 4.
Saccharine, 1888 ; 23.
Saccharum officinarum, 1888 ; 294. 1889 ; 242. 1890 ; 38, 71, 85. 1891 ; 10, 35.
St. Helena fruits, 1888 ; 252.
— Kitts and Nevis fruits, 1888 ; 215.
— — — — report of Mr. Morris's visit, 1891 ; 124.
— Lucia fruits, 1888 ; 185.
— — report of Mr. Morris's visit, 1891 ; 134.
St. Vincent fruits, 1888 ; 187.
— — report of Mr. Morris's visit, 1891 ; 140.
Sansevieria fibres, 1887, May ; 1.
Sapium biglandulosum, 1890 ; 149.
Scale-insect, fluted, 1889 ; 191.
— — orange, in Cyprus, 1891 ; 221.

Schweinfurth's method for preserving plants, 1889; 19.
Sechium edule, 1887, August; 6.
Securidaca longipedunculata, 1889; 222.
Seed and seminal variation in the sugar-cane, 1891; 10.
Seedlings of sugar-cane at Barbados, 1888; 294. 1889; 242. 1891; 10.
Seeds of herbaceous plants, list of, 1888; 25. 1889; 29. 1890; App. i. 1891; App. i.
— — trees and shrubs, list of, 1890; App. i. 1891; App. i.
Shantung cabbage, 1888; 137.
Short-podded Yam-bean, 1889; 121.
Shrubs and trees, list of seeds, 1890; App. i. 1891; App. i.
Siberian perennial flax, 1890; 104.
Sierra Leone fruits, 1888; 221.
Silkworm thorn, 1888; 291.
Silkworms, Ramie used as food for, 1890; 174.
Singapore gambier, 1889; 247.
— introduction of Brazil-nut, 1887, December; 11.
— rediscovery of Gutta Percha tree, 1891; 230.
Sisal hemp, 1887, March; 3.
— — at Bahamas, 1889; 57, 254. 1890; 158. 1891; 175.
Soil and cultivation in Yorubaland, 1890; 238.
Solenostemma Argel, 1891; 177.
South Africa, boxwood, 1887, February; 1.
— — fruits, 1888; 15.
— — Phylloxera, 1889; 230.
— — — regulations, 1889; 255.
— — prickly-pear, 1888; 165. 1890; 186.
South Australia fruits, 1888; 6.
Species of hardy Eucalyptus, 1889; 61.
Spices and flavouring materials:—
  Alpinia Galanga, 1891; 5.
  Economic plants of Madagascar, 1890; 200.
  Star anise, 1888; 173.
  Vanilla, 1888; 76.
Spigelia anthelmia, 1888; 265.
Staffs of Royal Gardens, Kew, &c., 1889; 122. 1890; 175. 1891; App. iii.
Star anise, 1888; 173.
Starch-yielding Bromeliad, 1889; 20.
Station, botanical, at Lagos, 1888; 149. 1889; 69. 1890; 162. 1891; 46.
— — at the Gold Coast, 1891; 169.
Stations, botanical, in the West Indies, 1887, June; 1. July; 9.
Staves, barrel, insect injury, 1890; 181.
Straits Settlements fruits, 1888; 250.
— — gambier, 1889; 247.
— — introduction of Brazil-nut, 1887, December; 11.
— — Liberian coffee, 1888; 261. 1890; 107.
— — Patchouli, 1888; 71, 133. 1889; 135.
— — planting in Perak, 1891; 220.
— — rediscovery of Gutta Percha tree, 1891; 230.
— — timber trees, 1890; 112.
Streblus paper, 1888; 81.
Sub-tropical and tropical plants, 1889; 287.
Sugar-cane, mites on, 1890; 85.
— — production of cane-sugar, 1891; 35.
— — "red rust," 1890; 86.
— — seedlings at Barbados, 1888; 294. 1889; 242. 1891; 10.
Sugar, Indian, 1890; 71.
— production of the world, 1890; 38.
Suæda fruticosa, 1891; 96.

T.

Tablet tea, 1890; 109.
Tagasaste, 1891; 239.
Tanning materials:—
  Canaigre, 1890; 63.
  Contributions from Colonial and Indian Exhibition 1886, 1887, September; 4.

Tanning materials—*cont.*
    Gambier, 1889; 247. 1891; 109, 110.
    Kath or pale cutch, 1891; 31.
    Valonia, 1888; 163.
Tarsonymus Bancrofti destructive to sugar-cane, 1890; 85.
Tasmanian fruits, 1888; 11.
— woods, 1889; 112.
Tea, 1888; 86.
— compressed or tablet, 1890; 109.
— oil and oil-cake, 1888; 264.
— P'u-êrh, 1889; 118, 139.
Tears, Job's, 1888; 144.
Teff, 1887, January; 2.
Theobroma Cacao, 1890; 170.
Thorn, the silkworm, 1888; 291.
Timber contributions from Colonial and Indian Exhibition 1886, 1887, September; 4.
— Gambia mahogany, 1890; 168.
— Inhambane copal, 1888; 281.
— Jamaica cogwood, 1889; 127.
— Jarrah, 1890; 188.
— of Madagascar, 1890; 200.
— — Straits Settlements, 1890; 112.
— — Tasmania, 1889; 112.
— — Yoruba-land, 1891; 41.
Tobacco, Persian, or Tombak, 1891; 77.
Tobago fruits, 1888; 190.
Tomato, tree, 1887, August; 2.
Tombak, or Persian tobacco, 1891; 77.
Treatment of mildew on vines, 1888; 270. 1889; 227. 1890; 190.
— — vines in France, 1888; 270. 1889; 227. 1890; 190.
Tree tomato, 1887, August; 2.
Trees and shrubs, list of seeds, 1890; App. i. 1891; App. i.
— timber, of Straits Settlements, 1890; 112.
— — — Tasmania, 1889; 112.
— — — Yoruba-land, 1891; 41.
Trinidad coffee, 1888; 129.
— fruits, 1888; 191.
— ipecacuanha, 1888; 269.
Tropical and sub-tropical plants, cool cultivation, 1889; 287.
Tunis, culture of vine, 1890; 36.
Turnsole, poisoning from, in Persia, 1889; 279.

U.

Uncaria Gambier, 1889; 247.
Upper Burma, india-rubber, 1888; 217.
Urera fibre, 1888; 84.

V.

Valonia in Cyprus, 1888; 163.
Value, commercial, of Loxa bark, 1890; 54.
Vanilla, 1888; 76.
Vegetable productions, Central China, 1889; 225.
Victoria fruits, 1888; 2.
— Phylloxera, 1890; 36.
Vine, Cochin China, 1888; 134.
— cultivation in the Gironde, 1889; 227.
— culture in Tunis, 1890; 36.
— treatment in France, 1888; 270. 1889; 227. 1890; 190.
— — of mildew on, 1888; 270. 1889; 227. 1890; 190.
Virgin Islands fruits, 1888; 215.
— — report of Mr. Morris's visit, 1891; 132.

W.

Weather plant, 1890; 1.
Weevils, preservation of grain from, 1890; 144.
West Africa, annatto, 1890; 141.
— — Assam rubber for, 1891; 97.
— — bass fibre, 1891; 1.
— — cotton, 1890; 135. 1891; 49.
— — cultural industries, 1889; 142. 1890; 195, 261.
— — fruits, 1888; 221.
— — indigo plants, 1888; 74.
— — rubbers, 1889; 63.
Western Australia, fruits, 1888; 10.

West Indian food plants introduced to East Indies, 1887, August; 1. 1889; 17.
— — fruits, 1888; 177, 197.
— — gambier, 1891; 109, 110.
— Indies botanical enterprise, 1891; 103.
— — — stations, 1887, June; 1. July; 9.
— — Yam-bean, 1889; 17, 62.
Wheat pest in Cyprus, 1889; 133.
Whisk, Mexican, or broom-root, 1887, December; 9.
Windward Islands, report of Mr. Morris's visit, 1891; 134.
Wine, colouring with Maqui berries, 1890; 34.
— production in France, 1890; 174.
Woods:—
  Cape boxwood, 1887, February; 1.
  Contributions from Colonial and Indian Exhibition 1886, 1887, September; 4.
  Gambia mahogany, 1890; 168.
  Inhambane copal tree, 1888; 281.
  Jamaica cogwood, 1889; 127.
  Jarrah wood, 1890; 188.
  Madagascar ebony, 1888; 135.
  — economic plants, 1890; 200.
Woods—*cont.*
  Sabicù wood, 1887, December; 4.
  Straits Settlements woods, 1890; 112.
  Tasmanian woods, 1889; 112.
  Yoruba-land woods, 1891; 41.
World's sugar production, 1890; 38.

Y.

Yam-bean, 1889; 17, 62.
— — short-podded, 1889; 121.
Yellow, Indian, 1890; 45.
Yoruba indigo, 1888; 74, 268.
— -land, indigenous plants, 1891; 206.
— — soil and cultivation, 1890; 238.
— — timber, 1891; 41.

Z.

Zalil, Persian, 1889; 111.
Zanzibar, climate of, 1890; 216.
Zealand, New, an edible fungus of, 1890; 217.
Zizyphus Chloroxylon, 1889; 127.